MBTA Revenue and Service Environmental Impact Report 1989 Fare Increase

Produced by
the Central
Transportation
Planning Staff for
the Massachusetts
Bay Transportation
Authority

MBTA Revenue and Service Environmental Impact Report 1989 Fare Increase

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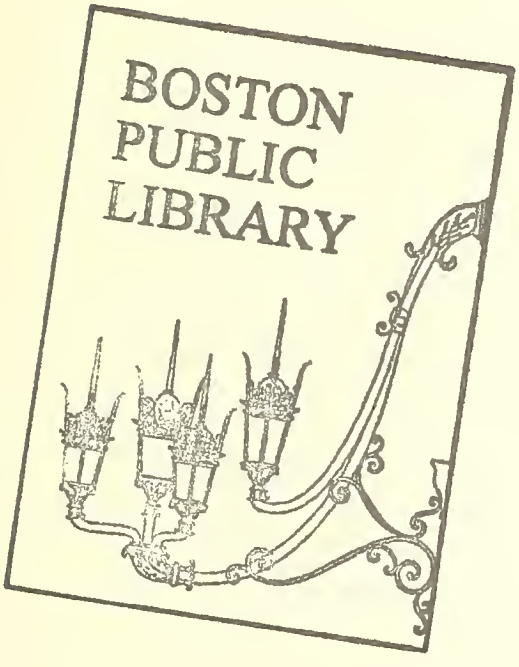

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An interagency transportation planning staff created and directed by the Metropolitan Planning Organization, which comprises:

Executive Office of Transportation and Construction
Massachusetts Bay Transportation Authority
Massachusetts Department of Public Works
MBTA Advisory Board
Massachusetts Port Authority
Metropolitan Area Planning Council

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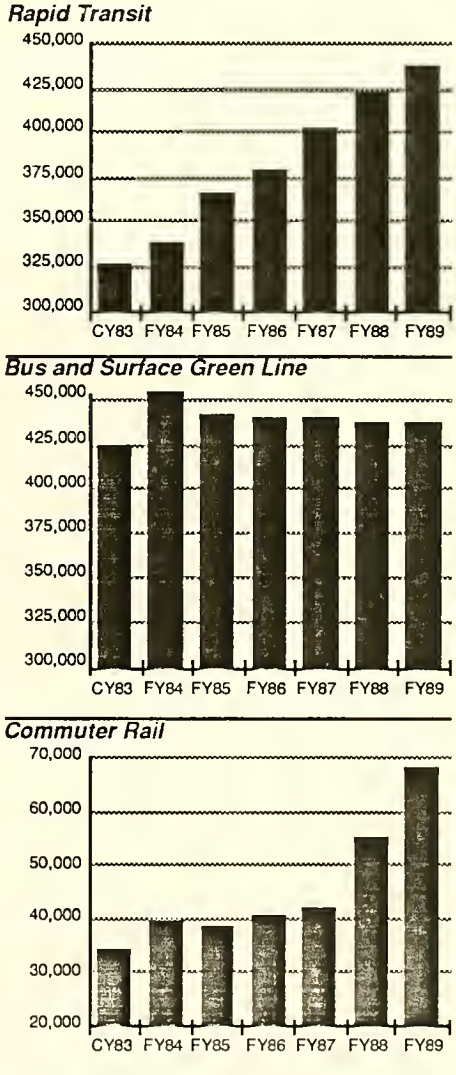
MBTA Revenue and Service Environmental Impact Report 1989 Fare Increase

Executive Summary

During the 1980's, the MBTA significantly upgraded and expanded rapid transit, bus and commuter rail service, and implemented commuter boat services. New rolling stock was purchased, rapid transit stations were modernized, the Red Line was extended to Alewife, the new Orange Line was constructed between Chinatown and Forest Hills, Red and Orange Line platforms were lengthened to accommodate six car trains, and parking has been expanded. To attract as many new riders to the modernized system as possible, fares were not changed between 1982 and 1989. The combination of service improvements, service expansion, and stable fares resulted in large ridership increases throughout most of the system. Between calendar year (CY) 1983, which was the first full year following the last fare changes, and fiscal year (FY) 1989,[1] average weekday ridership on rapid transit, surface Green Line, bus services, and commuter rail increased over 20 percent from 784,000 to 941,400 trips per weekday (see also Figure E-1).

Figure E-1
MBTA Weekday Ridership

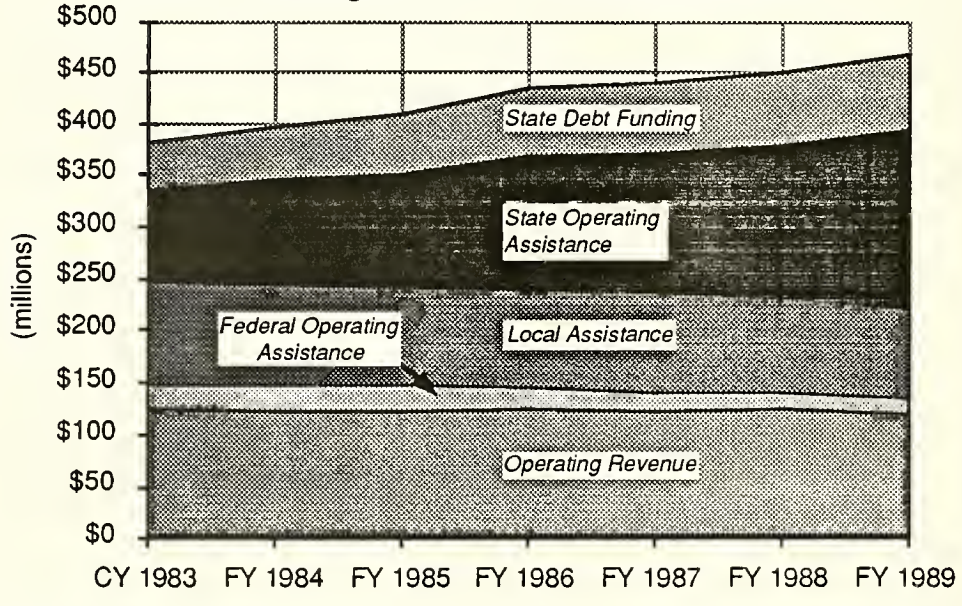


In 1989, a changing financial environment required that fares be increased to generate additional revenue. With efforts to upgrade the system and attract new ridership having been successful, and after six years of stable fare levels, the MBTA believed that a modest fare increase could be implemented with only minor ridership and environmental impacts. Further, to minimize ridership and environmental impacts, some market segments were exempted from the fare increase.

[1]The MBTA changed from a calendar to a fiscal year basis in 1984.

The decision to increase fares was largely the result of two factors: (1) the MBTA Advisory Board's Policy that fares should cover a minimum of 33 percent of operating expenses, and (2) the fact that local, state, and federal operating funding has become more limited. Federal operating assistance was reduced in the early 1980's and has remained constant since then. In addition, following passage of Proposition $2^1/_2$, the legislature limited increases in local assessments to $2^1/_2$ percent per year, far below the inflation rate. During the same period, fare revenue had been increasing with the growth in ridership, but not as fast as costs. The combination of these factors has resulted in higher operating deficits – projected at $486.3 million in FY 1990, up from $448.6 million in FY 1989. With local and federal operating assistance limited and fare levels fixed, higher state funding has been required (see Figure E-2). Recent state budget deficits in FY 1989 and FY 1990 are now limiting the availability of state funding.

Figure E-2
MBTA Funding Levels in Constant 1983 Dollars



MBTA operating costs have been increasing due to three factors: inflation, service expansion, and increased long term debt (for capital projects) that is repaid as part of the operating budget. These three factors combined have increased MBTA operating costs by an average of 7.2 percent per year between CY 1983 and FY 1989, which compares favorably with the 10.5 percent annual increase in state costs between FY 1983 and FY 1989. Further, for most state agencies, "budget buster" items such as health insurance, industrial accident costs, and debt service payments, are not included within the agency budget, but are covered within centralized accounts with Administration and Finance (A&F). If measured in terms of those items normally included in a state

agency budget, operating costs at the MBTA have risen by 5.4 percent per year. The MBTA has also taken advantage of the 1981 Management Rights Act to hold the growth in costs to reasonable levels by improving productivity. As a result, total FY 1989 operating costs, including the "budget busters", when measured against the vehicle miles of service provided in constant dollars, are lower than in CY 1982. For FY 1991, the MBTA has taken further steps to reduce costs by establishing goals in the following areas:

- Staff Reduction – Administrative budgets have been cut back and the MBTA has begun to reduce administrative staff. By the end of FY 1991, the MBTA expects to reduce administrative staff by 15 percent below originally projected FY 1990 levels. In total, the MBTA expects to employ 100 fewer personnel than it did in FY 1988.
- Overtime – The Authority capped overtime usage in FY 1990 at a level 20 percent below FY 1988 and five percent below FY 1989. Through the first eight months of FY 1990, total overtime hours are 25 percent below the prior year and nearly 40 percent below FY 1988.
- Scheduling Efficiencies – The Authority will implement additional management rights provisions in FY 1990 that will result in a more efficient use of labor in providing transportation services.
- Pension Savings - Last year the Authority renegotiated a new pension rate with its unions that saved $1.5 million.
- Health Insurance – The MBTA is auditing previous health insurance bills to identify those which should not have been paid and to recapture the money. While the MBTA's health insurance costs are expected to grow by 10 percent this year, this is significantly below the 15 to 20 percent growth rate expected by the industry.
- Workers Compensation – The MBTA is proceeding with greater use of "light duty" positions for injured employees, a proposed agreement with the Department of Revenue to match worker' compensation claims against their wage reporting files, and legislation that will prevent employees from simultaneously collecting both worker's compensation and a pension. While workers' compensation costs will continue to increase, the rate of growth will slow.
- Travel, Subscriptions, Telephone, Insurance – The MBTA has placed greater controls on out-of-state travel, subscriptions, outside printing, long distance telephone calls, and excess public liability insurance.

In addition, the MBTA is also pursuing a number of legislative initiatives that would result in reduced costs:

- Tort Liability – The State and all 351 of its communities are protected by a $100,000 liability cap on tort claims. By contrast, the MBTA has unlimited tort claim exposure. Granting the MBTA the same limitation on liability as that of the State and its cities and towns would eventually produce savings estimated at $4 million to $5 million per year in reduced

payments to claimants in judgments or settlements. In addition, insurance expenses could be cut by approximately $1 million per year.

- Workers' Compensation – Significant additional reform of worker's compensation laws could stem the double-digit growth in this expense category. This is an issue faced not only by the MBTA but also by all major employers in the Commonwealth.
- Revenue Bonds – Enactment of the authority to issue revenue bonds to allow appropriate capital projects to be self-financing, thereby reducing reliance in state debt assistance.
- Power Costs – The MBTA has proposed legislation that would authorize it to join NEPOOL, the New England consortium of electric power utilities. As a member of NEPOOL, the MBTA could shop for the lowest electric rates and save $2.1 - $3.2 million annually.
- Parking Enforcement – Legislation has been proposed to provide MBTA police with the power to enforce parking regulations on MBTA property. This will permit the maximization of revenues from MBTA parking lots.

THE MBTA ADVISORY BOARD'S FARE RECOVERY POLICY

Since 1984, the MBTA Advisory Board has proposed a policy that fares should cover a minimum of 33 percent of operating expenses. The Advisory Board believes that a minimum fare recovery ratio will keep pressure on the MBTA to run an efficient, cost-effective service and to increase productivity. The Advisory Board also believes that "modest, reasonably timed fare increases are in the long run in the best interest of public transit and of regular riders." For FY 1990, the Advisory Board resolved that the MBTA "develop and implement by July 1, 1989 a comprehensive plan to balance income and expenses so as to maintain a 33 percent fare recovery ratio in FY90."

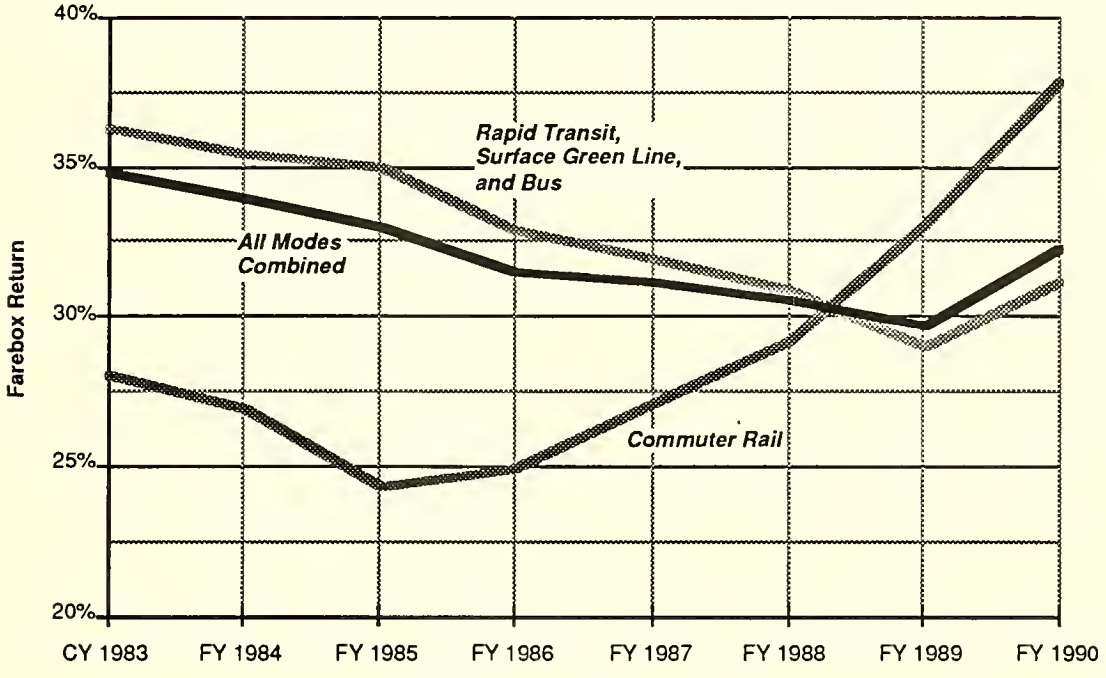
Between 1983 and 1989, constant fare levels meant that increases in fare revenue had been limited largely to increases in ridership. On this basis, fare revenue, including commuter rail revenue, has increased each year, at an average rate of 4.1 percent between CY 1983 and FY 1989. However, due to service expansion, inflation, and including increased costs for debt service, operating costs have increased at a rate of 7.2 percent. As a result, the operating deficit has increased.

The 1989 fare increase was originally intended to achieve a 33 percent fare recovery ratio for FY 1990. The projected ratio for FY 1990 will be 32 percent exclusive of interest income and debt service.[2] Although interest income and debt is included in the MBTA's operating budget, they are actually related to capital projects, and not a part of operations. Typically, income and

[2]The Local 589 arbitration award increased costs $18.1 million beyond projected levels. It is largely as a result of this increase that the revenue recovery ratio is now projected at lower levels.

expenses related to capital projects are excluded from revenue return calculations. Revenue return ratios between 1983 and 1990 are as shown in Figure E-3.

Figure E-3
Revenue Recovery Ratios - CY 1983 to FY 1990



IMPLEMENTATION OF THE 1989 FARE AND PARKING FEE INCREASES

Public Involvement in the Fare and Parking Fee Increases

The fare and parking fee increases were implemented following the MBTA's public hearing process. Generally, the public hearing process indicated an understanding on the part of the public of the need for increased revenue, particularly after several years of fare stability in the face of steady inflation. However, there was concern about the impact of fare increases on low income and other transit dependent groups, and about the proportionate share of the cost of the increase for those making long trips on commuter rail.

Subsequent hearings on service cuts, which were also under consideration, generated much more concern than the fare increase. The public response indicated that service cuts were far less acceptable than a fare increase. Most of the service concerns focused on the major effects which service cuts would

cause by limiting people's opportunity to gain access to work, social and medical activities.
Since the proposed fare increases were less than 30 percent, an Environmental Impact Report was not required prior to implementation of the fare increases. However, based upon input received during the public comment period, the MBTA and the Executive Office of Transportation and Construction (EOTC) agreed with the Executive Office of Environmental Affairs (EOEA) to prepare this report after the increases had taken effect. The purpose of the report was to examine the impact of the fare increases and parking fee increases, the Advisory Board's 33 percent fare recovery policy, as well as a number of other fare and service related issues, to guide future budgets. This report has been prepared in consultation with an advisory committee designated by EOEA in compliance with the agreement.

Based on the input received by the MBTA from the public, a number of changes were made to the original fare proposals. In general, the changes involved lessening the increases in fares for long commuter rail trips, and revising the pass program to provide larger discounts and greater flexibility (to both encourage riders to purchase passes and to lessen the impact of the fare increase on those regular riders). Parking fee increases, which were also reviewed through a public hearing process, were reduced in response to public comments.

The fare increase was planned and implemented within the existing fare structure for two major reasons. First, it was consistent with four major fare objectives of the MBTA that (1) the fare structure should be easy for customers to use and understand, (2) it should be easy and inexpensive to administer (including minimizing revenue collection costs), (3) it should minimize fare evasion, and (4) fares should be equitable. Second, it would allow the fare increase to be implemented in a timely manner.

Examination of the revised fare structure showed that the MBTA fare objectives have been largely satisfied. The fare structure has been made easier for customers to use and understand by reducing the number of passes for the most of the system to four: BUS, SUBWAY (Zone 1 subway, 75¢ Green Line), COMBO (bus, Zone 1 subway, all Green Line, and $1.25 express bus) and COMBO*PLUS* (all COMBO services plus Zone 2 & 3 subway and $1.50 express bus). Administration has been kept simple by continuing to use existing fare mediums: cash fares, tokens and passes. Fare evasion is minimized by requiring payment upon system entry, and within the constraints of other objectives, equity is maintained by charging similar fares for similar services.

Timing of the Fare and Parking Fee Increases

The 1989 fare increase raised fares for most rapid transit, express bus and commuter rail service, as well as on the D/Riverside branch of the surface Green Line. The fare increases were implemented in two phases: first

commuter rail fares were increased on March 1, 1989, and then two months later on May 1, rapid transit, D/Riverside surface Green Line, and express bus fares were increased. In both cases, to encourage pass purchases, cash fares were increased one or two months before pass prices. The pass structure was also revised to provide additional incentives for riders to purchase passes. Bus fares were left unchanged to maintain a lower cost alternative for low income transit dependent riders, and to lessen the impact of the fare increase on riders that transfer between modes.

Parking fees (at facilities where fees were charged) were increased at the end of October 1989. In December 1989, the MBTA began to charge a $1 per day parking fee at previously free commuter rail lots. A chronology of the fare and parking fee changes is as follows:

- March 1, 1989: Commuter rail cash fares increased by 17 to 33 percent.
- April 1, 1989: Commuter rail pass and multi-ride ticket prices increased by approximately 25 percent.
- May 1, 1989: Rapid transit, D/Riverside Green Line, and express bus fares increased by up to 32 percent.
- July 1, 1989: Rapid transit and express pass prices increased up to 30 percent, and new pass structure implemented.
- October 30, 1989: Parking Fees at most rapid transit parking lots, and Mattapan, Milton, and Arlington Heights, increased by $1 per day.
- December 4, 1989: $1 per day parking fee implemented at first five commuter rail parking lots (Canton Junction, Mishawum, North Billerica, Route 128, and Salem).
- January 2-16, 1990: $1 per day parking fee implemented at the Canton Center, Dedham Corporate Center, Forge Park, Franklin, Framingham, Norfolk, and West Natick commuter rail stations.
- June 4, 1990 and later: $1 per day parking fees scheduled for implementation at remaining MBTA commuter rail lots.

Before and After Cash Fares

Commuter Rail The first fare changes on March 1, 1989 increased commuter rail cash fares by an average of 24 percent. By zone, increases ranged from 15¢ to 75¢ (17 to 33 percent), with fares ranging from 60¢ to $4.50 increased to 75¢ and $5.25. In general, the percentage increases were lower as the length of the trip increased in order to lessen the dollar amount of the increase for the most expensive trips. All discounted fares for children, students, the elderly, and persons with disabilities increased as well, continuing to be priced at 50 percent of the adult fare (see also Table E-1).

Table E-1
Before and After Cash Fares

	Before	After	Increase
Adult Fares			
Local Bus			
Base Fare (1 Zone)	50¢	50¢	0%
Additional Zones (per zone)	25¢	25¢	0%
Rapid Transit			
Base Fare (Zone 1)	60¢	75¢	25%
Zone 2[3]	$1.20/60¢	$1.50/75¢	25%
Zone 3	$1.20	$1.50	25%
Surface Green Line[4]			
B, C & E Branches	75¢	75¢	0%
D Branch (except Newton Local)	75¢-$1.50	90¢-$1.75	17-20%
D Branch (Newton Local)	$1.50	90¢	-40%
Mattapan High Speed Line[3]	50¢	50¢	0%
Express Bus	$1.00-$1.50	$1.25-$1.90	25-32%
Commuter Rail	60¢-$4.50	75¢-$5.25	17-33%
Fares for Senior Citizens and Persons with Disabilities			
One Zone Bus and Rapid Transit and All Surface Green Line	10¢	10¢	0%
All Other	50% of Adult Fare		16-43%
Student Fares			
All Service	50% of Adult Fare		16-43%

Rapid Transit, Surface Green Line and Bus On May 1, 1989, rapid transit, express bus, and certain surface Green Line fares were increased. Rapid transit[5] fares were increased by 25 percent across the board. Zone 1 fares were increased from 60¢ to 75¢, Zone 2 trips were increased 60¢ to 75¢ for outbound trips and from $1.20 to $1.50 for inbound trips. Finally, Zone 3 trips were increased from $1.20 to $1.50 in both directions.

On the surface Green Line, only Riverside Line fares were increased. The surface portions of the Boston College, Cleveland Circle and Arborway lines, which operate in mixed traffic, and the Mattapan High Speed Line, are considered to be a combination of local bus and linehaul rapid transit, so fares were left unchanged. On the Riverside Branch of the Green Line, which has

[3]Two times base fare charged inbound/base fare outbound.
[4]Inbound fares; all outbound surface travel is free.
[5]Rapid transit is considered to include all Red, Orange and Blue Line service, and all subway and elevated Green Line service. It does not include surface Green Line service beyond Kenmore and Symphony.

an exclusive right of way similar to rapid transit, base fares were increased from 75¢ and $1.50 to 90¢ and $1.75, increases of 17 and 19 percent, respectively. In addition, a coupon system was also instituted in Newton to provide a 90¢ fare for local trips.[6] (Previously, local Newton riders were charged the same fare as riders travelling to Boston.)

Express bus fares increased from between $1.00 and $1.50 to between $1.25 and $1.90, increases of 25 to 32 percent. The express bus increases were similar to those for commuter rail trips of like distances.

Fares for the Elderly, Persons with Disabilities, Children and Students For all services with a base fare of 75¢ or less, the fare for the elderly and persons with disabilities was held constant at 10¢. For higher priced trips, the discount provided remained at 50 percent. The discount provided special children and students also remained at 50 percent.

Before and After Pass Prices

Commuter rail pass prices were increased on April 1, 1989; rapid transit and express bus pass prices were increased three months later on July 1, 1989. A new pass structure was also implemented on July 1, 1989. The new pass structure is generally more flexible and easier to use than the prior pass structure and increases the discounts provided for pass use. Major changes to the pass program are summarized below.

- The A Pass has been renamed the LOCAL BUS Pass but remains priced at $18. The LOCAL BUS pass can be used on the surface Green Line and as partial payment for service on zoned buses.

- The old B through F and commuter rail passes have been replaced by the new SUBWAY, COMBO, COMBO*PLUS*, and Commuter Rail Zone 1 through 11 passes. In most cases there is a one-to-one relationship between the old and new passes, with price increases ranging from 11 to 30 percent. To lessen the absolute price on the most expensive trips, the percentage increases are generally lower on higher priced passes and higher for lower priced passes. For nearly all subway and surface Green Line riders, the percentage increase in pass prices were lower than the percentage increase in cash fares. For commuter rail riders, the percent increase in pass prices was similar to the percentage increase in pass costs, but the dollar value of monthly pass savings increased. Some of the most significant savings now provided are as follows:

  - For Zone 1 express bus riders, the pass price increase was 11 percent, compared to a 25 percent increase in cash fares.

[6]Riders deboarding inbound trips in Newton receive a coupon valid for 85¢ off of the normal $1.75 fare on their next trip.

- For Riverside riders, cash fares increased by 19 percent, compared to the pass price increase of 11 percent.
- For Quincy Adams and Braintree riders, the break-even point for pass use has been reduced from 17 round trips to 16 round trips.
- For riders transferring between buses and rapid transit at Quincy Adams and Braintree, the pass price was reduced, while cash fares were increased.

In addition, 12-Ride tickets are sold for commuter rail service, and 10-Ride tickets are sold for express bus and Riverside Green Line service. As before the fare increase, commuter rail 12-Ride tickets continue to be priced at the cost of 11 one-way trips. On the Green Line and express buses, with different fares now being charged on the outer end of the Green Line and on Riverside express buses, the old 10-Ride ticket that cost $14.00 for ten $1.50 rides has now been split into two new tickets: an $18 ticket valid for ten $1.90 express bus trips and a $16.50 ticket valid for ten $1.75 Green Line trips.

Before and After Parking Fees

Parking fees at parking lots on rapid transit, the surface Green Line, and at Arlington Heights were increased by $1 per day on October 30, 1989. Parking fees are now between $2.00 or $2.50 at all stations with the exception of Alewife, which has a daily charge of $4.00 By line, daily fees at all lots on the Orange Line are now $2.50, all lots on the Blue line are $2.00, lots on the Green Line are $2.00, $2.25 or $2.50, and lots on the Red Line are $2.00, $2.50, or $4.00. Commuter rail parking fees are being implemented by groups of stations starting in December 1989. Parking fees at all stations will be $1 per day.

IMPACTS OF THE FARE AND PARKING FEE INCREASES

Projected Ridership Impacts

When the fare increases were implemented, the MBTA had projected an overall ridership loss of between 1.0 and 2.6 percent on rapid transit, the surface Green Line and buses, or between 7,230 to 17,680 trips per day. On commuter rail, expected losses were 4.2 to 10.2 percent, or 1,950 to 4,730 trips per day. The overall loss on all modes due to the fare increase was expected to be between 1.2 and 3.0 percent, or 9,180 to 22,410 trips per day.

Prior to the fare and parking fee increases, ridership increases had resulted in systemwide parking shortages, with all MBTA rapid transit parking lots, except Alewife, and most commuter rail lots, at or above capacity. These parking shortages effectively constrain the capacity of system and result in unmet transit demand. Recent estimates had also projected actual parking demand for rapid transit at up to 13,900 more spaces than the 16,858 spaces

that now exist. While the MBTA is now expanding parking to meet this demand, in the short term, the parking supply is fixed. As a result, losses in parking lot usage from existing riders were expected to be offset by new usage by those that previously could not find space available, and no significant net ridership impact was expected.

Observed Ridership Impacts

As expected, systemwide ridership declined slightly as a result of the fare increases. As shown in Table E-2, and including commuter rail, there was a 0.4 percent systemwide ridership decline attributable to the fare increase. If expected ridership growth is included, ridership after the fare increase is 1.9% less than has been anticipated in the absence of a fare increase.

The largest decline due to the fare increases was on rapid transit, where ridership declined 3.3 percent, or 12,730 trips per day. Some of these riders may have shifted to surface Green Line service or to bus service. On these modes, ridership increased by a total of 7,990 trips per day, or 2.3 percent. For the three modes combined, ridership declined by 0.5 percent, or by 3,540 trips per day.

The decline in rapid transit ridership and the increase in surface ridership represents a reversal of the ridership trends that had been occurring since 1983. Rapid transit ridership had been steadily increasing and surface ridership had been slightly declining. The fare increase has, at least temporarily, reversed these trends.

On commuter rail, ridership increased by 1.1 percent, or 490 trips per day, in spite of the fare increase. This was a lower rate of increase than had been occurring before the fare increase; however, these figures show that commuter rail continues to attract new riders even with higher fares.

The new pass structure has been successful in encouraging a greater percentage of riders to purchase passes and fewer to pay cash fares. Overall pass sales increased 3.5 percent between October 1988 and October 1989, with increases occurring in nearly all pass types. Even on rapid transit, although total ridership declined, pass ridership increased slightly.

Given the short period of time which had elapsed from the parking fee increases in October 1989 and the most recent available data from November, 1989, it is not possible to provide a truly representative estimate of the long-term parking-related ridership loss. The rapid transit, surface Green Line and Arlington Heights parking fee increases reduced the number of cars parking at MBTA lots by 7.5 percent through the middle of November 1989. This resulted in a loss of 1,200 daily rapid transit trips, 630 surface Green Line trips, and 190 daily bus trips, or 0.3 percent of total ridership. The total loss in

Table E-2
Summary of Ridership Before and After the Fare and Parking Fee Increases
(Average Daily Ridership)

	Rapid Transit	Surface Green Line	Bus	Subtotal RT/GL & Bus	Commuter Rail	Total
ACTUAL RIDERSHIP						
Before	**354,240**	**67,100**	**283,320**	**704,660**	**45,650**	**750,310**
After	**347,240**	**73,120**	**294,550**	**714,910**	**46,170**	**761,080**
Change	-7,000	+6,020	+11,230	+10,250	+520	+10,770
Percent Change	-2.0%	+9.0%	+4.0%	+1.5%	+1.1%	+1.4%
SEASONALLY ADJUSTED RIDERSHIP						
Before	**349,350**	**65,400**	**276,140**	**690,890**	**46,350**	**737,240**
After Fare Increase	**337,820**	**69,500**	**280,030**	**687,350**	**46,840**	**734,190**
Change Since Fare Increase	-11,530	+4,100	+3,890	-3,540	+490	-3,050
Percent Change	-3.3%	+6.3%	+1.4%	-0.5%	+1.1%	-0.4%
After Parking Fee Increase	**336,620**	**68,870**	**279,840**	**685,330**	**46,840**	**732,170**
Change Since Parking Fee Increase	-1,200	-630	-190	-2,020	NA	-2,020
Percent Change	-0.3%	-1.0%	-0.1%	-0.3%	NA	-0.3%
Total Change in Existing Ridership	-12,730	+3,470	+3,700	-5,560	+490	-5,070
Percent Change	-3.6%	+5.3%	+1.3%	-0.8%	+1.1%	-0.7%
Projected Ridership w/o Fare and and Parking Fee Increases	**361,270**	**65,050**	**274,640**	**700,960**	**47,415**	**748,375**
Difference from Observed:						
• After Fare Increase	-23,450	+4,450	+5,390	-13,610	-575	-14,185
Percent Change	-6.5%	+6.8%	+2.0%	-1.9%	-1.2%	-1.9%
• After Parking Fee Increases	-24,650	+3,820	+5,200	-15,630	-575	-16,205
Percent Change	-6.8%	5.9%	1.9%	-2.2%	-1.2%	-2.2%

Note: "Before" and "After" rapid transit, surface Green Line, and bus ridership refers to April 1989 and the end of October 1989. "Before" and "After" commuter rail ridership refers to February and October 1989.

existing ridership from the fare and parking fee increases combined was 5,070 trips per day, or 0.4 percent. It was anticipated that the large latent demand for more parking would quickly replace any ridership loss due to increased parking charges. In addition, an increased use of local buses, walking and possibly additional drop-off/pick-up was expected over time as a result of the higher parking costs.

The initial loss of riders resulting from parking fee increases has been higher than fare related losses because the parking fee increases were higher than the fare increases. Additionally, the short period between the parking price increase and the parking use counts has not been sufficient for the market to adjust to representative travel patterns. For rapid transit riders that do not park at the station, the fare changes increased costs by 30¢ per round trip, or by $5 - $7 per month, (depending on the number of commuting days and whether or not passes were purchased). For rapid transit riders that park at the station, the parking fee increase of $1 per day increased costs by another $20 - $22 per month. Combined, the fare and parking fee increases raised costs for rapid transit park and ride patrons by 31 to 59 percent.

These observed ridership changes indicate that the fare and parking fee increases did not significantly affect transit ridership or stimulate significant increases in automobile usage (33,487 additional vehicle miles per day, or 0.05 percent of the regional total). The 0.7 percent loss of riders was small, and lower than the expected ridership loss of 1.2 to 3.0 percent (see also Table E-3). Further, in recognizing that different people would react to the increases in different ways, and by continuing to provide low cost transit options for those most sensitive to the fare increase, the effect on total ridership was effectively mitigated in a number of areas:

Table E-3
Actual Versus Expected Ridership Changes
(Daily Ridership)

	Projected Loss	Actual Change	Difference
Rapid Transit, Bus and Surface Green Line			
Due to Fare Increase	7,230 - 17,680	-3,540	3,690 - 14,140
Due to Parking Increase	0	-2,020	2,020
Commuter Rail			
Due to Fare Increase	1,950 - 4,730	+490	2,440 - 5,220
Total			
All Modes, Due to Fare and Parking Fee Increases	9,180 - 22,410	-5,070	4,110 - 17,340

1) Commuter Rail The commuter rail fare increase, in response to public comment, was scaled so as to increase fares on long trips proportionally less than on short trips, recognizing that the specific dollar increases would still be greater for the longer trips. The fare increase was also mitigated by providing for deeper discounts for pass use than originally proposed. The quality of service on commuter rail has increased significantly because of added investment in new equipment. Also, increases in downtown Boston parking costs and traffic congestion continue to improve commuter rail's competitiveness relative to automobile options. This has resulted in steady growth in commuter rail ridership, and in spite of the fare increase, actual ridership was up by 1.1 percent.

2) Rapid Transit, Surface Green Line and Express Bus The quality of service has steadily improved as a result of the major capital investment in both fixed plant and rolling stock. This has been reflected in steady ridership increases on the three modes. The fare increase was mitigated by increasing discounts on prepaid passes and by providing the opportunity to purchase eleven tokens for the price of ten. Actual rapid transit ridership went down by 3.3 percent as a result of the fare increase. This was a modest but significant change in light of prior experience of steady ridership growth, but the increased utilization of the pass program indicates that the revised pass program was an effective mitigation strategy.

The cash fare increase was also mitigated by leaving local bus and B, C, and E branch surface Green Line fares constant. This was done for two reasons. First, many transit trips actually involve a rapid transit plus bus trip, so that leaving bus fares constant reduced the impact on riders that use both services. This is analogous to the less than proportional increases for the longest commuter rail trips in recognition of the large increase in absolute costs. It was also in recognition that a transfer between modes inherently results in a lower quality trip than a one-ride rapid transit trip. Secondly, leaving bus and surface Green Line fares constant, permitted the riders that were the most sensitive to cost to avoid the fare increase by using bus routes which parallel rapid transit lines. This appears to have occurred, in that surface ridership, which had been stagnant or slightly declining over the past five years, increased by 2.3 percent, offsetting much of the rapid transit ridership loss.

3) Parking Fee Increase Parking fees impact only four percent of MBTA rapid transit, surface Green Line and bus riders, and most parking lots were at capacity. For this reason, it was believed that increases in parking charges would tend to have minimal impact on ridership in that any loss of ridership due to increased parking charges would be offset by other latent parking demand from potential riders who had been frustrated by the shortage of parking.

Further, to the degree that customers would seek to avoid the rapid transit parking fee increases by walking to the station, ridesharing, or using feeder buses, the result would be more efficient use of a scare resource (parking). The marginal cost of adding parking to deal with the capacity shortage through the construction of structured parking garages is up to $20,000 per space, a daily cost of approximately seven dollars. Therefore, to the extent that an adjustment in parking fees encourages riders to access MBTA service by other means, it is less damaging than other increases. The changes in parking lot utilization following the parking fee increases have initially indicated a greater loss than expected, which needs to be carefully monitored through additional surveys.

Socio-Economic and Environmental Impacts of the Fare Increase

The environmental impact of a fare increase upon riders with an automobile available is measured in terms of air pollution resulting from increased automobile vehicle miles traveled and traffic congestion. Socioeconomic impacts principally effect riders who do not have access to an automobile (so-called "captive" riders) and, as a consequence, have less access to employment, educational, social and health care opportunities, and less income available for other needs than do auto owners.

Fare increases typically result in lower ridership losses among captive riders because these riders have fewer alternatives. As a result, there is usually a greater direct impact on these riders' travel costs, in proportion to income, than with transit riders who have other choices (discretionary riders). Conversely, ridership impacts are often greater among the more affluent discretionary riders because they usually do have other alternatives available. To the extent that these riders shift from transit to automobile, there will be adverse environmental impacts. The 1989 fare increase was designed to minimize both types of impacts to the greatest extent possible. This was done by holding bus and surface Green Line fares level, and increasing fares for the most expensive fares proportionally less than other trips. Also, discounts for elderly riders and those with disabilities were maintained. The result was that many low income and transit dependent riders were not affected at all, and for many of those that were, a lower cost alternative (bus service) was available since local bus fares were not increased. The reversal of the historical decline in bus ridership following the fare increase indicates that many riders did make this shift[7]. Furthermore, for those riders that were affected by the fare increase, the cost increase was a relatively small five to eight dollars per month, which, when adjusted for inflation over the years

[7] Fewer bus alternatives exist for commuter rail and boat services and concerns for the impact of these fare changes on the less affluent riders of these services was evident at the public hearings.

since the last fare increase, is not large in relation to other consumer expenditures.

Changes in the number of automobile vehicle miles travelled (VMT) resulting from the fare and parking fee increases in the region were small, relative to total regional travel. The total increase is estimated at 33,487 VMT per day, an increase of 0.05 percent. The air quality impacts related to this change in VMT were also small. Further, given the high level of market demand for transit service, a reduction of service levels as an alternative to a price increase would likely have a much more significant impact on ridership levels, VMT and air quality.

REVENUE AND FARE ISSUES

MBTA Funding: Existing and Potential Alternative Sources

Funding the MBTA is a matter of balancing income between those who use the system and non-users who benefit from the system. This is based on the public policy, as reflected in legislation, that all who benefit from the system either directly or indirectly should contribute to its costs.

Financial support for transit produces a number of different types of benefits to both users and non-users of the services. Transit riders benefit directly from the financial support which subsidizes their fares. Businesses benefit by being able to attract employees and customers more easily and from an expanded geographic base and property owners benefit as improved access increases land values around transit stations. Other non-transit users also benefit from transit service through reduced traffic congestion. The MBTA carries approximately 600,000 linked trips per weekday, most of which would be auto trips without transit service, and could not be accommodated on the existing highway system. Other benefits are also achieved in the attainment of lower levels of air and noise pollution and in the form of dense development which brings a reduction of costs for the provision of many urban services. The benefits which accrue to society as a whole are supported by federal, state and local funding sources as well as by the individuals who use the system.

Most other American transit systems are partially financed through one or more dedicated funding sources such as sales taxes and gasoline excise taxes. The use of dedicated funding for other agencies results in a more stable funding base and a lower reliance upon state funding than is the case for the MBTA. Unlike in Massachussets, transit systems in other states receive a significant portion of their funding from dedicated sources.

As a result of recent constraints on state funding in addition to a fixed level of federal funding and a $2^1/_2\%$ per year increase in local funding, an

examination was performed on potential alternative funding sources. In terms of potential revenue, impacts, and administration requirements, a comparison of each is contained in Table E-4. Most of the revenue sources listed are used in other areas and have been proven to be generally acceptable to the public. A more balanced "portfolio" of funding sources could make the MBTA less reliant on state funding and more resistant to changing economic conditions.

Impacts of a 33 Percent Revenue Recovery Ratio

As previously mentioned, the MBTA Advisory Board has proposed a policy since 1984 that fares should cover a minimum of 33 percent of operating expenses. In January 1990, the state passed legislation requiring the MBTA to achieve a 33 percent revenue recovery ratio.

There are a number of ways in which fare increases could be implemented to achieve a 33 percent revenue recovery ratio. For example, they could occur across the board, or they could be applied selectively to certain services, as was done with the 1989 fare increase. Changes could also be made to the fare structure to increase revenue. With moderate inflation and continued ridership growth, a 33 percent revenue level could be achieved with relatively moderate fare increases. However, with higher inflation or other unexpected cost increases, significantly higher fare increases and/or service cuts could be required to achieve a 33% revenue recovery ratio. Such actions may result in significantly lower ridership levels.

With fares raised to achieve a 33 percent revenue return ratio, the increase in operating subsidies would be partially mitigated. However, operating subsidy requirements would still increase at an annual rate of approximately 6.5 percent per year, so the increases would continue to be sizeable. Under current law, there could be no impact on local assessments, which would continue to be capped at an increase of 2.5 percent per year.

Fare Structure Options

Due to unique characteristics of individual areas, there is no "best" fare structure for any given system. The existing MBTA fare structure is a combination of a flat-fare system and a zone-based system. Although all modes operate based on a zone system, the large majority of all trips are made within one zone. Thus, most riders are charged the same as they would be under a "pure" flat-fare system. Exceptions are the commuter rail system and express bus service, where most riders pay more than base fares. With only a few exceptions, free transfers are permitted only within the rapid transit system; no free or discounted transfers are permitted between different modes or between buses. (However, some monthly passes include the equivalent of free or discounted transfers.)

Table E - 4
Alternative Transit Revenue Sources

Transportion Related Revenue Alternatives		Revenue Criteria				Impacts								Administration			
		Potential Revenue (in Millions $)	Rate	Stability	Inflation Resistance	Progressivity	Equity	On Transit Use (Ridership Change)	On Automobile Use	Political Acceptability	Existing Mechanisms	Ease of Implementation	Cost	Legislative Change	Used in MA*	Used in US
Transit-Related Alternatives																
	Fares	16.8	to $1.00	high	low	low	high	low	high	low	yes	good	low	no	T	√
	Advertising	2.0	varies	high	high	n/a	high	n/a	n/a	high	yes	good	low	no	T	√
	Real Estate including Fiber Optics	2.5 - 10.5	varies	medium	high	none	high	high	n/a	high	yes	good	low	no	T	√
	Transit Parking Fee Increases	4	+$1 •	high	low	low	high	low	high	low	yes	good	low	no	T	√
Other Transportation Related Revenue Sources																
Motor Vehicle Fees	Registration taxes	5.4	$10	high	low	low	low	none	low	low	yes	good	low	yes	G	√
	Drivers license fees	1.8	$5	high	low	low	low	none	low	low	yes	good	low	yes	G	√
	Gasoline taxes	20	6¢/2¢/2¢	high	low	low	low	high	low	medium	yes	good	low	yes	G/T	√
	Bridge and Highway tolls	4.5 - 18	varies	low	high	low	low	high	low	medium	yes	good	low	yes	G	√
	Windfall Profits Parking Tax (in parking freeze areas)	10 - 15	$1/day permit	high	low	high	low	n/a	low	low	no	poor	unknown	unknown	no	no
	Non-residential Parking surcharge	5.8	$100. per space	high	high	high	low	n/a	low	medium	no	poor	medium	unknown	no	no
	Parking surcharge (District-wide)	14	$1/day permit	high	low	low	low	high	low	low	no	poor	medium	yes	no	no
	Special Road Use Charges	varies	varies	high	low	low	low	high	low	low	no	poor	high	yes	no	no

• parking fee increase of $1. at most stations

* Taxes collected for
G=general revenue purposes
T=taxes collected are transit dedicated

Table E-4 (continued)
Alternative Transit Revenue Sources

General Revenue Alternatives (to be transit-dedicated)	Revenue Criteria: Potential Revenue (in Millions $)	Rate	Stability	Inflation Resistance	Impacts: Progressivity	Equity	On Transit Use (Ridership Change)	On Automobile Use	Political Acceptability	Existing Mechanisms	Administration: Ease of Implementation	Cost	Legislative Change	Used in MA*	Used in US
Dedicated MBTA Sales tax	160-240	1%	poor	high	low	low	NI	NI	medium	yes	high	low	yes	G	√
Dedicated MBTA Property Tax Dedicated Real Estate Assessments	varies	varies	good	high	low	low	NI	NI	low	no	medium	low	yes	G	√
Dedicated MBTA Benefit Assessments	varies	varies	good	low	high	high	high	NI	medium	no	medium	low	yes	No	√
Dedicated MBTA Value Capture Development Density Uses	varies	varies	good	high	high	high	high	NI	high	no	low	low	no	No	√
Development Parking Fees	varies	varies	good	high	high	high	high	low	medium	no	medium	low	yes	No	√
Development Impact Fees	varies	varies	good	high	high	high	NI	NI	high	no	medium	low	yes	No	√
Dedicated Income-based Taxes Dedicated MBTA Income Tax	72	.50%	high	high	high	low	NI	NI	low	yes	good	low	yes	G	√
Dedicated MBTA District Payroll Tax	200	.50%	high	high	low	low	NI	NI	low	yes	good	low	yes	No	√

NI = No Impact

* Taxes collected for
G=general revenue purposes
T=taxes collected are transit dedicated

It is possible that certain characteristics of other fare structures, as listed below, could improve the existing fare structure without sacrificing its current benefits.

- Revised zone system.
- Elimination of fare differential between bus and rapid transit.
- Free/discounted transfers between all rapid transit and local bus services.
- Free/discounted transfers at certain rapid transit stations.
- Free/discounted transfers between specific bus routes and rapid transit.
- Free/discounted transfers between local bus routes.
- Free/discounted transfers between express bus and rapid transit.
- Peak/off-peak pricing.
- Distance-based fare system for rapid transit (similar to BART or WMATA, but taking into account surface Green Line operations).
- Adjust discounts provided to different ridership groups and those using passes.

The implementation of any one or more of the above options would affect both fares and ridership. For example, if free transfers were provided throughout the system, base fares would need to be increased to compensate for the loss of transfer revenue. Higher base fares would likely lead to a decrease in the number of trips not involving transfers, but free transfers would likely result in an increase in the number of transfer trips. In summary, each option would have a number of associated advantages and disadvantages. Further, most could be implemented singly or in combination with others. The specific impacts of each option would be dependent on proposed revenue goals and the specific combinations to be considered.

Fare Collection Methods

The fare collection methods used by the MBTA are, to a large degree, a function of the fare structure, as well as cost and accountability considerations. Currently, four types of fare payment are accepted: cash, token, prepaid pass, or ticket. Passes are accepted on all services, tokens are accepted on bus routes and the rapid transit system, and tickets are used only on commuter rail, the D/Riverside branch of the Green Line and express buses. Cash is accepted on all buses at all times for all fares. On the rapid transit system, cash is accepted for discounted fares at all times, but for full fares only when gatemen's boxes are open (usually during peak periods or special events).

While these fare payment methods are simple to administer, they impose a number of limitations on the type of fare structure that can be used. If it were decided to use transfers, electronic fareboxes on buses and LRV's, and devices that dispense transfers, would help avoid fare evasion and improve ridership data collection. A comprehensive, automated, distance-based fare structure would require a major change in turnstile and station layout, but would

allow for simpler implementation of periodic fare increases, reduce fare evasion, and allow fare charges to be more closely linked to the distance travelled. The MBTA is in the process of procuring electronic fareboxes for buses, and is beginning a test of token vending machines on the Riverside branch of the Green Line. has begun to investigate the use of more flexible equipment for fare collection for use with both the existing fare structure and distance-based fare structures.[8]

ISSUES FOR FUTURE CONSIDERATION

The 1989 fare and parking fee increases had a smaller impact on ridership than was originally expected, with total ridership down 0.4 percent due to the fare increase and 0.3 percent due to the rapid transit, surface Green Line and Arlington Heights parking fee increases. Based on the ridership impacts by mode, it appears that the implementation of the fare increase was successful in mitigating socioeconomic impacts on low income and transit dependent riders. It can also be concluded that environmental impacts of the fare increase were minimal. The small impact of the fare and parking fee increases also indicates that the improvements made to service throughout the 1980's have been effective in attracting people to the system and keeping them on MBTA service in spite of the fare increase.

In future years, with a 33 percent revenue recovery ratio, the MBTA will need to implement additional fare increases while maintaining ridership growth. The experience of this fare increase indicates that this may be possible, and raises the following issues for consideration before subsequent fare increases:

1) Adjust zone fares to increase fares from zones where longer trips are provided at relatively low fares.

2) Increase rapid transit fares to $1.00, but maintain the local bus fare at 50¢ to continue to provide a low cost transit option to lower income transit dependent riders. These fares would result in the average transit patron who transfers between bus and rapid transit service paying an average round trip fare of $3.00 per day. It would be necessary to review the impact upon longer trips costing two tokens, and there would need to be continued stability in bus fares to provide an option to customers who might otherwise be forced to forego travel.

3) Maintain surface Green Line and local bus fares at existing levels. On these modes, increases in traffic congestion tend to erode the quality of surface Green Line service in mixed traffic over time. Therefore, it is

[8]This includes the procurement of electronic fareboxes for buses, which is now underway, and a test of token vending machines on the Riverside branch of the Green Line in the Summer of 1990.

difficult to offset fare increases on surface Green Line service with quality of service improvements, as has been done on rapid transit and commuter rail. An increase in local bus fares to 75¢ could be considered, but would be a low priority because it would remove the safety valve which the low local bus fare currently provides. Adjustments in this area would also require consideration of free or discounted transfers, which could increase the complexity of the fare system.

4) Change the state statute restricting the elderly fare to 10¢, and increase the fare to 25¢ or 50¢. These fares have not been adjusted for inflation since they were set in 1982, and are far below the federal requirement of a 50 percent discount only during off-peak hours. This appears to be an area with the potential for increased revenue with less severe environmental or social consequences.

5) Develop a one week pass, or a ten ride discounted ticket, to improve convenience and offset the impact of fare increases on part time workers and lower income customers for whom a monthly pass is not a reasonable option.

6) Additional increases in parking fees. On the rapid transit system, different parking fees are charged at different lots. At stations with lower parking fees, further increases may be possible without significantly affecting ridership. On commuter rail, due to the higher absolute cost of service, parking fee increases may be more difficult to implement.

7) Peak/Off-Peak Pricing. Off-peak ridership is typically more sensitive to fare increases than peak period ridership. Therefore, to mitigate the impact of future increases, it may be desirable to institute a peak/off-peak pricing structure in which fares are only increased for peak period trips, or in which a fare increase for off-peak trips is lower than for peak period trips.

In addition, other means of maintaining a 33 percent revenue recovery ratio will be to continue to reduce costs through increased productivity, as well as to successfully market off-peak services, where additional ridership can be accommodated on existing service.

1. MEPA Certificates

Certificate of the Secretary of Environmental Affairs on the Environmental Notification Form (March 15, 1989)

Certificate of the Secretary of Environmental Affairs Establishing the Scope for the MBTA Revenue and Service Environmental Impact Report (April 5, 1989)

Certificate of the Secretary of Environmental Affairs on the Draft Environmental Impact Form (December 4, 1989)

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

MICHAEL S DUKAKIS
GOVERNOR

JOHN DEVILLARS
SECRETARY

March 15, 1989

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	: MBTA 1989 Fare Increase
PROJECT LOCATION	: Boston Metropolitan Area
EOEA NUMBER	: 7551
PROJECT PROPONENT	: MBTA
DATE NOTICED IN MONITOR	: February 8 and 27, 1989

Pursuant to the Massachusetts Environmental Policy Act (G.L.,c.30,s.61-62H) and Section 11.06 of the MEPA regulations (301 CMR 11.00), I hereby determine that the above project does not require the preparation of an Environmental Impact Report. However, I am calling for a full EIR on MBTA revenue and service issues generally.

It is my intent, in this decision, and in the Revenue and Service EIR, that every effort be taken to encourage the use of the MBTA transit system and to reduce reliance on the private automobile for commuting into and moving about the Boston metropolitan area. In this fashion, not only will better service be provided to the users of rapid transit, but significant improvements can be made to regional air quality problems through the reduction of automobile use.

In this extended review, several points have emerged. First among these is that there is general assent that the proposed fare increase is warranted and appropriate. Second is that several aspects of the overall MBTA fare structure, system operations, and system management deserve further review. Finally, the MBTA, in an agreement with then Secretary Bewick dated July 31, 1981, committed itself to the prepare a Generic Environmental Impact Report, a Socio-Economic Report, and a Management Report (which were done) and to update those reports "every time it raises its fares...". Even so, it is my determination that the proposed fare increase may go forward, subject to certain conditions, and that a full Environmental Impact Report (including the general content of all three earlier reports) must be prepared. This EIR is to be prepared and reviewed as both a Draft and a Final EIR within one year. No

further increases in fares may occur until its completion.

The Secretary of Transportation and Construction has proposed that, before the current proposed fare increases go into effect, the MBTA will:

1. Discount bulk purchases of subway tokens by selling 10-packs for the price of nine tokens;

2. Freeze monthly pass prices until July 1, 1989 and, prior to increasing the prices, assess alternative pricing structures - the results to be reported to me in a brief letter report prior to the increase; and

3. Develop and propose a method for passenger counts and ridership estimates and develop a preliminary baseline count for use in the EIR - also to be reported to me in a brief letter report.

These conditions must be met prior to the implementation of the current proposed fare increase. I shall publish notice of receipt of both letter reports in the Environmental Monitor and will accept comments upon them for 30 days, so that I may better assess these two documents.

The MBTA Revenue and Service EIR will be the subject of a separate scope, to be issued following additional consultation with interested parties. I expect that the scope will include a broad examination of the MBTA Advisory Board fare box revenue recovery policy and alternatives for MBTA revenue, a detailed assessment of existing and proposed service and ridership, and a careful analysis of the environmental, social, and economic effects of MBTA revenue and service policies and practices.

March 15, 1989
DATE

JOHN DeVILLARS, SECRETARY

Comments received:
CLF - 2/6/89
Johnson - 2/16/89
APT - 2/20/89
CLF - 2/23/89
APT - 2/28/89
Bahne - 2/28/89
BTD - 2/28/89
Advisory Board - 3/7/89
BRA - 3/9/89
MAPC - 3/10/89
CLF - 3/14/89

JPD/SCD/sd

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

MICHAEL S. DUKAKIS
GOVERNOR

JOHN DEVILLARS
SECRETARY

April 5, 1989

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ESTABLISHING THE SCOPE FOR THE MBTA REVENUE AND SERVICE ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: MBTA 1989 Fare Increase
PROJECT LOCATION	: Boston Metropolitan Area
EOEA NUMBER	: 7551
PROJECT PROPONENT	: MBTA
DATE NOTICED IN MONITOR	: February 8 and 27, 1989

Pursuant to the Massachusetts Environmental Policy Act (G.L.,c.30,s.61-62H) and Sections 11.04 and 11.06 of the MEPA regulations (301 CMR 11.00), I determined on March 5, 1989 that the above project requires the preparation of an Environmental Impact Report.

Since the decision on March 15, I have consulted further with parties who expressed interest in this EIR, received a proposed scope from the MBTA, and received additional written comment. The results of that process convince me that, while there is some dissent, the decision to allow the proposed fare increase to take place was and is appropriate and that, following the submission of additional information, the pass pricing structure also may be changed.

Scope

The MBTA has proposed a through and thoughtful scope for the Revenue and Service EIR. With some additions, described below, I do adopt that scope as part of this certificate and incorporate it by reference and attachment.

Comments

The comments received during the original and the extended review are of unusual quality and must guide the MBTA in carrying out the Revenue and Service EIR. I adopt them as my own and

direct that, except as they deal with the timing of the present fare and pass price increases, they be considered as part of the scope for this EIR. So that these comments may be properly reflected, I require that they be attached to the Draft EIR and either dealt with clearly in the body of the text or responded to individually.

Advisory Committee

Since it is expected that the scope of this effort will evolve and be refined in the coming months, the MBTA has agreed to the establishment of an advisory committee for this project. I shall seek nominations for the Revenue and Service Advisory Committee (RSAC) in the next Environmental Monitor and will appoint a six to ten member committee as soon as is practical. The MBTA shall consult regularly with the RSAC during the development of the EIR and shall provide copies of formal submissions to the RSAC at least 15 days before they are filed for MEPA review. The RSAC shall comment directly to the MEPA Unit on documents and may seek its guidance or clarification on any point of dispute during this process.

Schedule

The March 15 certificate sets a one year time frame for the filing of both the Draft and Final EIRs. In order that needed fall data collection efforts may be incorporated into the EIR without undue delay in review, three documents will be prepared and reviewed:

1. a Draft EIR, containing all sections of the scope that do not directly depend on the fall data gathering - due October 5, 1989,

2. a Supplement to the Draft EIR, containing the fall data and analyses - due February 5, 1990, and

3. a Final EIR, incorporating responses to comments on both earlier documents - due April 5, 1990.

These documents will allow for an orderly and thorough review of the MBTA Revenue and Service EIR in the time frame set in my March 15, 1989 Certificate.

April 5, 1989
DATE

JOHN DeVILLARS, SECRETARY

Comments received: MRPC - 4/3/89
Behne - 3/30/89, 3/6/89, & 3/1/89
CLF - 3/28/89
BTD - 3/27/89
Kaiser - 3/27/89 & 3/14/89
Certificate and Attachments - 3/15/89

JPD/SCD/sd

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

MICHAEL S. DUKAKIS
GOVERNOR

JOHN DEVILLARS
SECRETARY

December 4, 1989

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: MBTA Revenue and Service Environmental Impact Report
PROJECT LOCATION	: Statewide
EOEA NUMBER	: 7551
PROJECT PROPONENT	: Massachusetts Bay Transportation Authority
DATE NOTICED IN MONITOR	: October 26, 1989

The Secretary of Environmental Affairs herein issues a statement that the Draft Environmental Impact Report submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (G.L.,c.30,s61-62H) and with its implementing regulations (301 CMR 11.00).

The Draft Revenue and Service Environmental Impact Report (Draft report) has fallen somewhat short of my expectations as envisioned for this report in the Secretary's Certificate of March 15, 1989. Regardless of whether the Draft report is adequate, the review process for the Revenue and Service EIR process has always envisioned that a supplement to the Draft EIR be prepared. It is now all the more important that the substance and scope of the supplemental report be expanded to more fully respond to not only the comments received on the draft report, but the comments received on the original Environmental Notification Form (ENF) filing.

I found the Draft report to be an informative document, but, as noted by several commenters, I also found it to be less analytical than expected. Another failing was the omission of the MEPA documentation which is required for any Draft EIR. The supplemental report should be prepared in the form of a report which stands by itself, a revision to the Draft report. Comments received on the ENF and the Draft report must be responded to, either in the text of the report or in a separate section of the

report. In any case, it must be clear where the responses to specific comments may be found in the supplemental report.

With this decision, I am also modifying the filing deadline for the supplemental report. The Secretary's Certificate of April 5, 1989 for this project envisioned a filing date of February 5, 1990. Judging from the substance and tenor of the attached comments, I now consider this date somewhat optimistic. Accordingly, I am willing to consider an extension of this deadline. While I understand that this action will no doubt extend the MEPA review process beyond the one year period envisioned for this project, I feel that the process is better served by a more comprehensive report rather than a report which may only be timely. The prohibition on additional fare increases until the completion of the MEPA review process will still be in effect.

The attached comments are again of unusual depth and clarity and must be responded to in the supplemental report, in that they deal with the issues raised in the detailed examination of revenue and service policies and practices. The report should be viewed in the context of a Generic EIR in that MBTA policy is at issue, however, a detailed examination of the MBTA Advisory Board fare recovery ratio proposal will need to be included.

I assume the fall data gathering efforts have been completed, and thus these results should be included in the supplemental report. The MBTA should provide an analysis of the effect the increase in parking fees at commuter rail and rapid transit garages has had on ridership as well as, of course, the fare increase. The supplemental report should also include an analysis of parking fees and the authority's strategy for increased parking fees and any likely impact on ridership envisioned by those increases. I also encourage the MBTA to explore other creative revenue mechanisms such as increased advertising or leasing of rights of way (for fiber optic cables) as identified by the MBTA Advisory Board Finance Subcommittee, and analyze the relationship of such revenue increases to the MBTA's fare policies and programs.

I extend an offer to meet with the Revenue and Service Advisory Committee and the MBTA to discuss the issues raised in the RSAC comment letter dated November 21, 1989.

EOEA #7551 DEIR Certificate December 4, 1989

December 4, 1989
Date

John DeVillars, Secretary

Comments received :

10/11/89 - Association for Public Transportation, Inc.
11/21/89 - Revenue and Service Advisory Committee
11/27/89 - Charles Bahne, Jr.
11/28/89 - MBTA Advisory Board
11/29/89 - Boston Transportation Department

JD/JWF/jwf

2. Introduction

During the 1980's, the MBTA has significantly upgraded and expanded rapid transit, bus and commuter rail service, and implemented commuter boat services. New rolling stock has been purchased, rapid transit stations have been modernized, the Red Line was extended to Alewife, the new Orange Line was constructed between Chinatown and Forest Hills, Red and Orange Line platforms were lengthened to accommodate six car trains, and parking has been expanded. To attract as many new riders to the modernized system as possible, fares had not been been changed since 1982.

The combination of service improvements, service expansion, and stable fares has resulted in large ridership increases throughout most of the system. Between CY 1983 (the first full year following the last fare changes) and FY 1988, average weekday ridership on rapid transit, surface Green Line and bus services increased over 14 percent from 749,300 to 859,600 trips per weekday.

In 1989, a changing financial environment required that fares be increased to generate additional revenue. With efforts to upgrade the system and attract new ridership having been successful, and after six years of stable fare levels, the MBTA believed that a modest fare increase could be implemented with only minor ridership and environmental impacts. Further, to minimize ridership and environmental impacts, some market segments were exempted from the fare increase.

The decision to increase fares has largely been the result of two factors: (1) the MBTA Advisory Board's Policy that fares should cover a minimum of 33 percent of operating expenses, and (2) that local, state, and federal operating funding has become more limited. Federal operating assistance was reduced in the early 1980's and has remained constant since then. In addition, Proposition $2^1/_2$ has limited increases in local assessments to $2^1/_2$ percent per year, far below the inflation rate. During the same period, fare revenue has been increasing with the growth in ridership, but not as fast as costs. The combination of these factors has resulted in higher operating deficits – projected at $486.3 million in FY 1990, up from $448.6 million in FY 1989 (see Table 2-1). With local and federal operating assistance limited and fare levels fixed, higher state funding has been required. Recent state budget deficits in FY 1989 and FY 1990 are now limiting the availability of state funding.

Table 2-1
MBTA Operating Budgets, FY 1985 - FY 1990
($ Millions)

	FY 1985 Actual	FY 1986 Actual	FY 1987 Actual	FY 1988 Actual	FY 1989 Actual	FY 1990 Budget
Cost of Service						
Operating Expenses	364.4	392.9	412.4	443.2	470.9	505.3
Fixed Charges	68.5	77.9	83.3	92.1	104.9	124.3
Total	432.9	470.8	495.7	535.3	575.9	629.6
Operating Revenue						
Fare Revenues	103.2	104.8	108.6	112.2	114.5	128.1
Other Revenue	14.2	18.4	15.4	19.8	12.7	15.2
Total	117.4	123.2	124.0	132.0	127.2	143.3
Operating Deficit	315.5	347.5	371.7	403.2	448.7	486.3

MBTA operating costs have been increasing due to three factors: inflation, service expansion, and increased long term debt (for capital projects) that is repaid as part of the operating budget. These three factors combined have increased MBTA operating costs by an average of 7.2 percent per year between CY 1983 and FY 1989, which compares favorably with the 10.5 percent overall increase in state costs. Further, for most state agencies, "budget buster" items such as health insurance, industrial accident costs, and debt service payments, are not included within the agency budget, but are covered within centralized accounts with Administration and Finance (A&F). If measured in terms of those items normally included in an agency budget, operating costs at the MBTA have risen by 5.4 percent per year. The MBTA has also taken advantage of the 1981 Management Rights Act to hold the growth in costs to reasonable levels by improving productivity. As a result, total operating costs, including the "budget busters", when measured on a per mile basis in constant dollars, have been declining since FY 1985.

Therefore, as a result of all the conditions described above, the MBTA increased fares to generate the additional revenue needed to sustain operations. The MBTA expects the new fares to increase FY 1990 rapid transit, surface Green Line and express bus revenue by $13.6 million, and commuter rail revenue by $3.5 million. This increase, coupled with funding approval of the supplemental budget and $4 million in operating cost reductions, should provide adequate operating funding for the MBTA for FY 1990.

PUBLIC INVOLVEMENT IN THE FARE AND PARKING FEE INCREASES

The fare and parking fee increases were implemented following the MBTA's public hearing process. Generally, the public hearing process indicated an understanding on the part of the public of the need for increased fare revenue, particularly after several years of fare stability in the face of steady inflation. However, there was concern about the impact of fare increases on low income and other transit dependent groups, and about the proportionate share of the cost of the increase for those making long trips on commuter rail.

Subsequent hearings on service cuts, which were also under consideration, generated much more concern than the fare increase. The public response indicated that service cuts were far less acceptable than a fare increase. Most of the service concerns focused on the major effects which service cuts would cause by limiting people's opportunity to gain access to work, social and medical activities.

Based on the input received by the MBTA from the public, a number of changes were made to the original fare proposals. In general, the changes involved lessening the increases in fares for long commuter rail trips, and revising the pass program to provide larger discounts and greater flexibility (to both encourage riders to purchase passes and to lessen the impact of the fare increase on those regular riders). Parking fee increases, which were also reviewed through a public hearing process, were reduced in response to public comments.

Since the proposed fare increases were less than 30 percent, an Environmental Impact Report was not required prior to implementation of the fare increases. However, based upon input received during the public comment period, the MBTA and the Executive Office of Transportation and Construction (EOTC) agreed with the Executive Office of Environmental Affairs (EOEA) to prepare this report after the increases had taken effect. The purpose of the report was to examine the impact of the fare increases and parking fee increases, the Advisory Board's 33 percent fare recovery policy, as well as a number of other fare and service related issues (as described below), to guide future budgets.

This Supplemental Draft Revenue and Service Environmental Impact Report responds that agreement and to the Secretary of Environmental Affairs Certificate Establishing the Scope for the MBTA Revenue and Service Environmental Impact Report (April 5, 1989) and the Certificate of the Secretary of Environmental Affairs on the Draft Environmental Impact Form

(December 4, 1989).[1] It includes a revised version of the October 1989 draft, as well as the additional information required for the supplemental draft.

To assist in developing a Revenue and Service EIR that is responsive to the varied concerns of those commenting at the EIR scoping meeting, the Secretary initiated a Revenue and Service Citizen Advisory Committee (RSAC). Reporting directly to the Secretary of Environmental Affairs, the RSAC is comprised of four members representing the following organizations: The Association for Public Transportation, Inc., the Conservation Law Foundation, the MBTA Advisory Board, and the Metropolitan Area Planning Council. The group has met to review and discuss the document at several stages in its preparation and has been instrumental in shaping its contents.

In addition to the ridership, revenue and environmental impacts of the fare and parking fee increases, a number of other issues were examined: These included an assessment of the implications of the MBTA Advisory Board's proposal of a 33 percent fare recovery ratio, existing and proposed service and ridership plans and projections, alternative financing options, and alternative fare structure and fare collection options. This report, prepared by the Central Transportation Planning Staff (CTPS) at the request of the MBTA, is being filed in fulfillment of these requirements.

To place the 1989 fare increase in context, this report also presents a description of the fare and parking fee increases, existing and projected MBTA services, relevant MBTA service and fare policies, ridership monitoring and estimation procedures, service planning processes, ridership, and ridership trends. Also included in this Draft Supplemental EIR is a presentation of ridership change data and the socioeconomic/environmental impacts of the fare change through the Fall of 1989. Impacts are disaggregated to isolate the effects on specific geographic areas, wherever possible. Finally, this report also addresses comments received from EOEA, the RSAC, the MBTA Advisory Board and other interested parties.

ORGANIZATION OF REPORT

This report, as required, describes and examines MBTA service, fare and funding practices and policies, and the ridership, revenue, socio-economic and environmental impacts of the fare increase. In addition to this chapter, information is presented as follows:

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[1] Certificate of the Secretary of Environmental Affairs, EOEA #7551, Environmental Monitor Dates, February 8 and 27, 1989, March 15, 1989.

- Chapter 1, MEPA Correspondence: This chapter includes the MEPA certificates received to date.

- Chapter 2, Introduction

- Chapter 3, Policy Framework for the MBTA: Chapter 3 describes the MBTA's policies, goals, and objectives with respect to service provision and fares. It also describes the basis for these policies, goals and objectives.

- Chapter 4, Description of Existing MBTA Service and Service Planning Processes: This chapter describes the service that the MBTA now provides, as well as the processes the MBTA uses to evaluate current and proposed services.

- Chapter 5, MBTA Service and Ridership: Trends and Projections: This chapter describes changes in MBTA service and ridership since the last fare changes, as well as projections of future expansion and ridership growth.

- Chapter 6, MBTA Fares and Parking Fees Before and After the Fare Increase: Chapter 6 describes fares before and after the 1989 fare increase, the timing of the fare increase, and how the value of fares has changed over time. Also described are the changes in parking fees at selected MBTA stations.

- Chapter 7, MBTA Service Monitoring and Ridership Estimation Procedures: Chapter 7 described the methods used by the MBTA to monitor the performance of its services and to estimate ridership. This chapter includes a description of the method used to estimate the before and after ridership impacts of the 1989 fare increase.

- Chapter 8, Impacts of the Fare and Parking Fee Increases: Chapter 8 describes the ridership, revenue, socio-economic and environmental impacts of the 1989 fare increase. The chapter also summarizes the impacts of the parking fee increases at rapid transit, surface Green Line and bus parking lots and the related ridership changes.

- Chapter 9, MBTA Funding: Existing and Potential Sources: This Chapter provides information on current MBTA funding sources including Federal, State and local transit subsidies and all existing sources of direct revenue. The Chapter provides an inventory of potential financing options and evaluates the revenue, impact and feasibility of each as a future funding source.

- Chapter 10, Revenue Recovery Ratio Issues: Chapter 10 examines the impacts of a 33 percent recovery ratio on MBTA ridership, future fare levels, revenue, subsidy levels, and the environment.

- Chapter 11, Fare Structure: The final chapter examines the current fare structure of the MBTA and evaluates alternative structures and collection methods.

- Appendices: Two appendices, which are bound separately, contain responses to comments from the public hearing and the draft EIR and the initial forecasts of the ridership impacts of the fare increase made at the time the fare increase was implemented.

3. Policy Framework for the MBTA

The MBTA serves 78 Massachusetts cities and towns with a population of more than 2,600,000 (see Figure 3-1). It is controlled by a seven member Board of Directors whose Chairman is the Secretary of Transportation for the Commonwealth. The General Manager controls the day-to-day operations of the Authority and is responsible for overseeing the various directorates and departments shown in the organizational chart in Figure 3-2. The MBTA Advisory Board, which is comprised of local officials representing the cities and towns in the district, reviews and approves the MBTA annual operating budget.

As an integral part of the Boston regional transportation system, a number of goals and objectives have been developed as part of regional planning efforts. These goals and objectives have been ratified by the agencies which comprise the Metropolitan Planning Organization – The MBTA, the MBTA Advisory Board, the Executive Office of Transportation and Construction, the Massachusetts Department of Public Works, Massport, and the Metropolitan Area Planning Council.

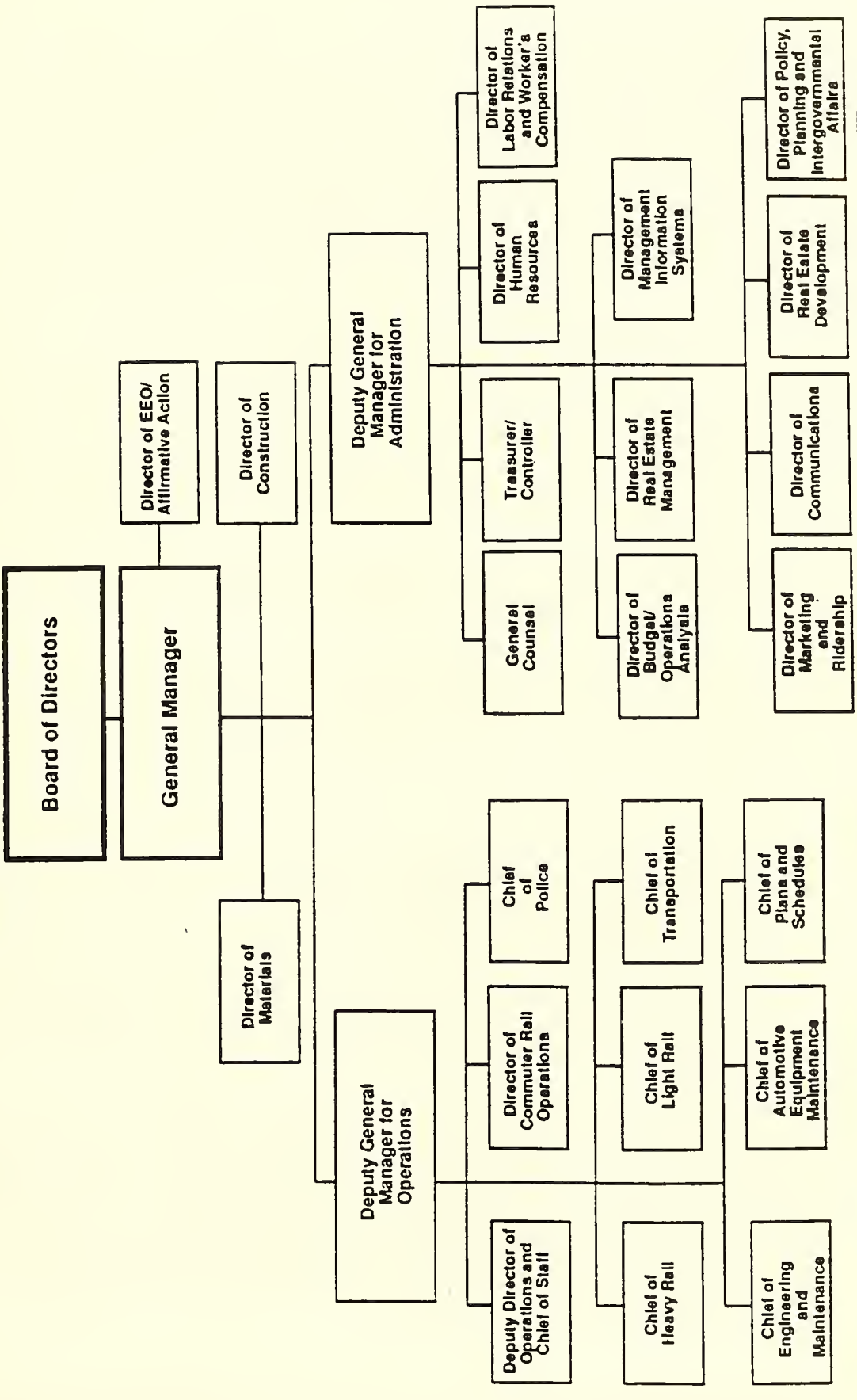
Overall, the MBTA's role in the region's transportation system is to provide and improve transit services in a manner which enhances the quality of life for the people who live, work and travel in the region. To do this, the MBTA is guided by a number of specific goals and objectives. These goals and objectives are an outgrowth of the 1977 Program for Mass Transportation (PMT), combined with current management priorities and fiscal constraints. Those most relevant to the financing and pricing of transit service are presented below.

MBTA GOALS AND POLICIES

The MBTA's primary goal is to provide a reliable, comfortable, and convenient service that meets the needs of existing riders and attracts new passengers while operating on a limited budget. This includes:

Figure 3 - 1
MBTA Service Area: 78 Member Cities and Towns

Figure 3 - 2
MBTA Organizational Structure



Management Goals

The MBTA has a number of management goals relating to customer service, employee morale, ridership, revenue, costs, and service quality. With many major expansion and modernization projects completed or nearing completion, a major focus of MBTA management is now that of improving customer service and employee morale (which, in turn, should lead to further improvements in customer service). In more detail, these goals are as follows:

- Improve Customer Service – operate a safe, clean efficient transit system that provides reliable service with friendly personnel.

- Improve Employee Morale – improve work scheduling, provide employees with clean, well maintained equipment with which to perform their jobs, increase women and minority representation, reward and recognize employee performance, and revitalize employee associations.

- Increase Ridership – attract additional riders who can be served at reasonable cost with available funding.

- Control the Overall Financial Burden – control the overall costs of supplying public transportation and seek an equitable distribution of the resultant financial burden among riders and public revenue sources.

- Improve Quality of Service – improve the quality of service offered through modernized facilities, new vehicles and more reliable operation.

- Reduce Costs and Increase Productivity – through management initiatives such as minimizing absenteeism and health costs, as well as service refinements.

- Improve Safety and Security – minimize the hazards to which riders and employees are exposed in connection with public transportation service.

Social Goals

The provision of transit service provides mobility for many individuals that have no other travel alternatives due to low income or physical disability. Transit also reduces pollution and reduces congestion by providing an alternative to private automobiles, and can be used as an impetus for urban revitalization. Using transit service to achieve these goals provides social benefits but usually increases the cost of providing transit service. These higher costs are addressed in the PMT:

> "It is important to recognize that achievement of social goals may impose costs on the MBTA which are in excess of those associated with a strictly operating efficiency criterion. Investment of resources for social purposes produces returns, but not ones as easily identified as more riders or lower costs. Therefore, a dilemma facing the MBTA and the public will be how to share more equitably the burden of MBTA cost. Within the MBTA's control is the ability to achieve greater efficiency in both operations and construction, in order to stabilize the relationship between fare revenues and operating costs. Yet to be resolved is how the public will choose to share in the increasing costs of the MBTA as a means for achieving social goals."

The MBTA does accept higher costs in order to provide additional service to riders with special needs and to meet other social goals. These goals include:

- Provision of Service for Riders with Special Needs. Providing transportation service for the elderly and persons with disabilities, particularly those who do not have access to an automobile. Service is provided through "The Ride" service, the purchase of lift-equipped buses and construction projects to make rapid transit and commuter rail accessible for persons with disabilities.

- Land Use and Development. Contribute to and facilitate the process of land use planning and development for the long term, as in the Southwest Corridor and at other locations when disposing of excess property.

Financial Responsibilities

The MBTA funds its operating expenses with fare revenues, federal operating assistance, state operating assistance and local assessments. Over the past few years, federal operating assistance has either declined or remained at constant levels, and increases in local assessments have been capped at 2 1/2 percent per year by Proposition 2 1/2, leaving a higher percentage of operating costs to be funded by fare revenues and the State. Although fares had remained constant between 1983 and 1989, fare revenues have increased due to increasing ridership, but not at as high of a rate as overall operating expenses. As a result, fare revenues now fund a smaller part of the operating costs: 34 percent in FY 1983 after the last fare increase, compared to 30 percent in FY 1989. With these sources funding a decreasing percentage of total costs, significant increases in state assistance have been required to fund remaining costs. Recent state budget problems have limited the extent to which the Commonwealth can continue to cover the shrinking Federal and local percentage shares of the costs of running the MBTA.

In this environment, MBTA management believes that it must maximize operating revenues as well as contain costs in order to maintain and expand service. In addition to implementing a fare increase as a means of increasing revenue, the MBTA seeks to enhance its revenue by leasing real estate where feasible. This includes joint development in conjunction with new rapid transit stations and station modernization work, as is being done at South Station, through the concession leases at Alewife station, and the construction of an underground parking garage at the new North Station. These types of efforts will be undertaken wherever it is both profitable to the MBTA and convenient to passengers, where it does not impede transportation operations or passenger flow, is consistent with good design and land use practice, and where it is consistent with guidelines of the Federal government for use of grant funds.

Fare Policies

The MBTA believes that fares should be set to create a balance between maximizing revenue and maximizing ridership. Until recently, the emphasis has been on maximizing ridership, which has resulted in MBTA fares being comparably modest, both before and after the fare increase. Now, with current funding constraints, the emphasis has shifted more towards generating additional revenue.

In addition, recent legislation (MGL 653, Section 199) requires the MBTA to recover at least $33^1/_3$ percent of its operating costs through fare revenues, other operating revenues (parking fees, lease revenues, etc.) and UMTA Section 9 funding. Therefore, future fare levels will be set consistent with this requirement as well. Expected "triggers" for fare increases will then be limitations in other funding (as in the past), and/or the $33^1/_3$ percent requirement.[2]

With respect to specific fare levels, the MBTA currently has a two-tiered fare structure that provides lower fares for bus riders. This fare differential has been set to provide a low cost transit option to lower income transit dependent riders. The MBTA also provides a number of other reduced fares to other transit dependent groups – the elderly, persons with disabilities, and students. The two-tiered rapid transit/bus fare is based upon MBTA policies, while fares for the elderly, persons with disabilities, and students are set based upon state law.

Depending upon financing conditions, future fare increases could be either implemented across the board, or be limited to certain ridership segments, as

[2]For additional information on the impacts of the $33^1/_3$ percent revenue recovery requirement, see Chapter 10, Revenue Recovery Issues.

was the case with the 1989 fare increase. Based upon the results of this study, future MBTA fare increases will likely focus on the following areas:[3]

- Adjustment of zone fares to increase fares from zones where longer trips are provided at relatively low fares.
- An increase in rapid transit fares to $1.00.
- A change the state statutes to allow the elderly fare to be increased.
- Development of a one week pass, or a ten ride discounted ticket, to improve convenience and offset the impact of fare increases on part time workers and lower income customers for whom a monthly pass is not a reasonable option.
- Additional increases in parking fees.
- Peak/Off-Peak Pricing.

However, prior to any subsequent fare changes, the MBTA will examine each of these, and other options, based on prevailing conditions.

In terms of its fare structure, the MBTA has four major objectives. These are that the fare structure be:

(1) easy to use and understand,
(2) easy to administer and that administration costs are minimized,
(3) designed to minimize fare evasion, and
(4) equitable.

In addition, the MBTA provides various discounts to certain groups to achieve the social goals discussed above. These include discounts to elderly and riders with disabilities and students. Elderly and discounts for disabled persons, which are set by state law, exceed federal regulations which require that fares for these groups be no more than 50 percent of full fares. Base fares for elderly and handicapped persons were not increased as part of the fare increase and remain at 10¢.

In December of 1988, the MBTA Advisory Board took action to restate its position that fares should cover at least 33 percent of operating expenses. Although this action was not binding on the MBTA, it was a major impetus of the fare increase. The Advisory Board stressed that while endorsing major public commitments to mass transit in Boston through state and local subsidy, as representatives of the cities and towns in the state, they were increasingly conscious of the fierce competition for limited public funds. The Committee encouraged the MBTA to generate more of its funding through fares and to implement this through a fare increase.

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[3]For further discussion, see Chapter 8, (Impacts of the Fare and Parking Fee Increases), and the "Issues for Future Consideration" section of the Executive Summary.

Environmental Improvement and Fuel Consumption

Moving people by public transit creates less air pollution than by private automobile on a passenger/mile basis. Therefore, a general policy of promoting mass transportation is beneficial with respect to air quality.

In addition, it is the MBTA's policy to reduce the pollution generating characteristics of its system by renewal and replacement of its existing power distribution system and of its buses, trolleys, and diesel rail engines. For example, the MBTA is now engaged in several pilot programs to test buses that use alternative fuels. Furthermore, it is MBTA policy to minimize energy consumption and pollution levels by eliminating energy intensive practices such as running bus engines overnight. Finally, Federal requirements for planning certification and for capital assistance also provide assurance that air quality is considered in MBTA planning and management.

It is also MBTA policy to take all reasonable design measures to reduce noise, particularly in residential areas and in areas of high employment density. This includes the design of vehicles and stations.

LONG RANGE TRANSPORTATION SYSTEM POLICIES

The MBTA is an integral part of the Boston regional transportation system, for which goals and objectives have been developed as part of regional long range planning efforts. These goals and objectives have been ratified by the agencies which comprise the Metropolitan Planning Organization – The MBTA, the MBTA Advisory Board, the Executive Office of Transportation and Construction, the Massachusetts Department of Public Works, Massport, and the Metropolitan Area Planning Council.

The primary goal of the transportation program for the Boston region is to improve the region's transportation facilities and services in a manner which enhances the quality of life for the people who live, work and travel here. Those transit policies most relevant to the financing and pricing of mass transit are presented below.

Costs in Operating the Transportation System

The policy for cost control focuses on the reduction of costs and the implementation of projects which reduce operating requirements. In part, the policy states:

> "Through increasing the productivity of the public transportation system operations and improving construction and maintenance

techniques for the transportation system as a whole, the costs of operating the system can be controlled."

To accomplish this, the MBTA strives to make optimum use of existing facilities in order to incur a minimum of capital outlays. It is MBTA policy to analyze low-cost alternatives for all projects and emphasize projects which increase the use and capacity of existing facilities and/or improve the efficiency of the existing transportation system.

Equity and Accessibility

The transportation system must serve all of the people of the region, without bias based on geographic location, income, race, or physical disability. The system must strive to provide a real choice of transportation modes to all segments of society.

Transportation systems should be designed to service equitably and reinforce the social and economic vitality of the region's communities. In addition, special emphasis should be placed on meeting the transportation requirements of those with special needs (e.g., the elderly, the disabled, economically deprived, etc.). Objectives in this respect are the following:

(1) Increase Accessibility to Populations with Special Needs. An objective of the transportation plan is to make the transit system more accessible to persons with physical disabilities, where economically and technologically possible; otherwise, to provide for specially designed service.

(2) Increase Sensitivity to Needs of Minorities and Low-Income Groups. Future design and planning of facilities should be particularly sensitive to the special needs of minorities and low-income groups. These people are particularly affected by the high cost of travel by private automobile, which severely inhibits their participation in the job market and other economic spheres. Facilities should be desinged to maximize access to employment centers from high unemployment/low income residential areas.

Energy

The transportation program must ensure that conservation and the efficient utilization of energy resources occur in both the operation of facilities and the development of new infrastructure.

Because fossil fuels are a limited resource, actions that decrease fuel consumption per trip (for example, by increasing auto-occupancy rates and by increasing transit usage and the number of passengers per transit vehicle) are

emphasized. Ideally, a reduction in fuel consumption will not affect the total number of person trips in the region. The overall goal of the Regional Transportation Plan in this respect is to coordinate and encourage an energy-conserving transportation system which offers modal choice while maintaining efficiency. For its part, the MBTA:

(1) supports improvements in transportation that conserve energy,

(2) continues to develop and improve the transit system as an energy-efficient form of transportation, and as a reliable alternative to the private automobile,

(3) emphasizes strategies and actions that decrease fuel consumption per trip, and

(4) works to improve the energy-efficiency of its own fleet and equipment.

Environmental Quality

The regional plan includes measures to reduce air, noise, and water pollution in order to attain and maintain the highest possible level of environmental quality for the region. The MBTA's role in this is the following:

(1) Reduce the number of vehicle miles travelled (VMT) regionwide by drawing automobile users to the transit system. Reduction in VMT will lead to air quality improvements, reduced land requirements of highways and parking facilities, and other environmental benefits.

(2) Influence land use decisions to encourage high density development along major transit corridors. This will increase transit usage, reduce traffic congestion, and improve air quality.

SUMMARY

Overall, the basic policy framework for transportation planning within the region is to provide an efficient transportation system that is environmentally compatible, socially equitable, energy conscious, cost efficient, and consistent with regional land use and economic development goals. The MBTA system is one part of an overall strategy to achieve this goal.

As described above, many of the MBTA's policies have been adopted to achieve regional goals, while others are more specific to MBTA operations. In most cases, various goals and objectives are compatible. In some cases,

balances must be achieved between accomplishing more wide-ranging regional goals and providing basic service levels.

4. Description of Existing MBTA Service and Service Planning Processes

DESCRIPTION OF EXISTING SERVICE

The MBTA operates a system of four rapid transit and light rail lines, and 155 bus routes. In total, 11,000 trips are operated on these routes each weekday between approximately 5:00 am and 1:30 am. Additionally, the MBTA also provides for the operation of 11 commuter rail lines, and two commuter boat routes. Specialized accessible transportation is provided in 44 cities and towns, and the MBTA subsidizes private bus service provided by six companies and suburban bus service operated in 12 towns.

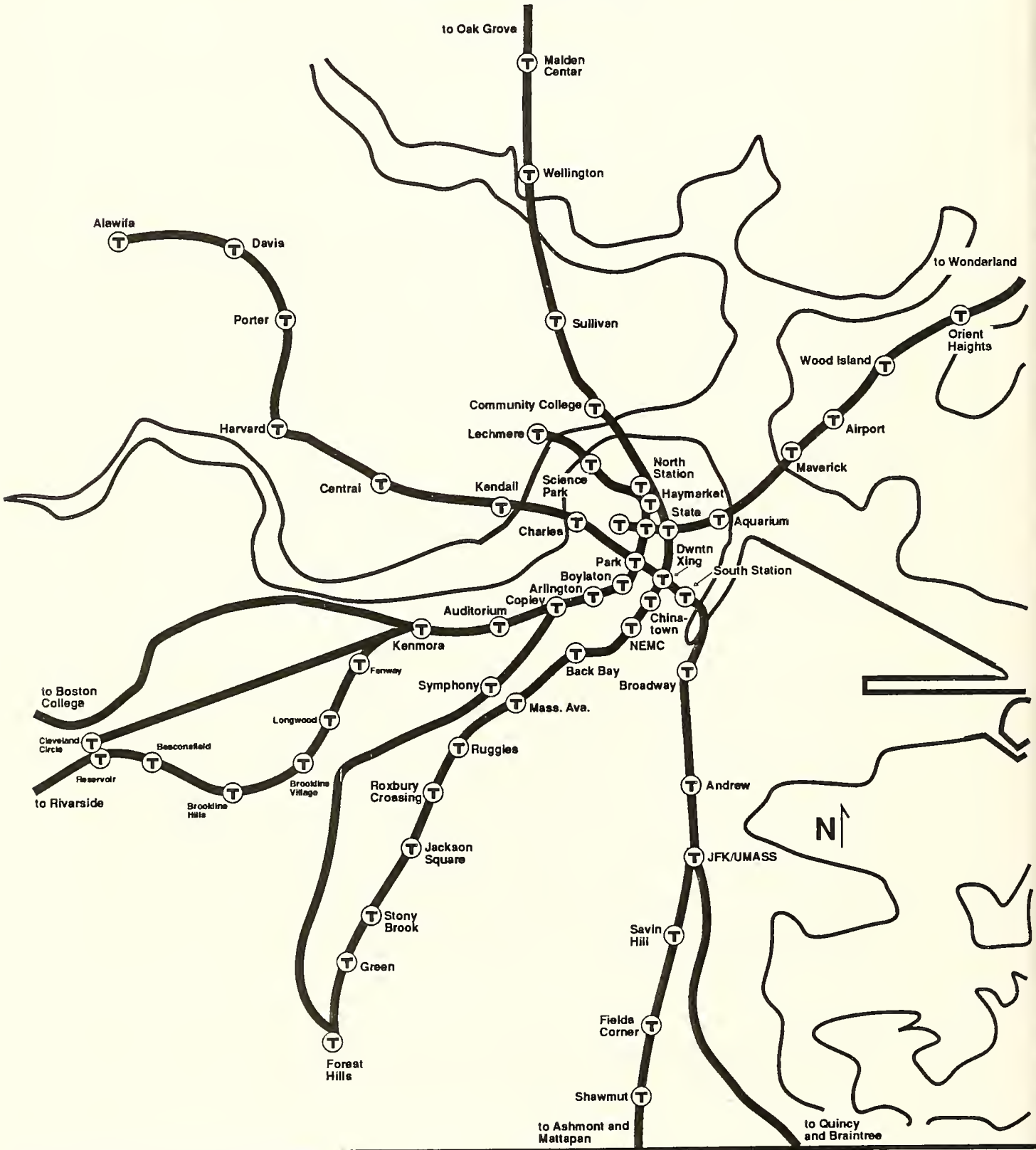
Rail Rapid Transit and Light Rail Transit

The MBTA rapid transit system is comprised of four lines and 81 stations: the Red Line, the Orange Line, the Green Line, and the Blue Line (see Figure 4-1). All lines provide service to downtown Boston, and all lines connect with each other except for the Red and Blue Lines. Daily ridership on the rapid transit system is approximately 579,000 trips per weekday.

Red Line Of the four lines, the Red Line is the longest and, along with the Green Line, the most heavily utilized, carrying approximately 185,000 passenger trips per weekday. The Red Line has two branches, with service running between Alewife Station in North Cambridge and Ashmont Station in Dorchester or Braintree Station in Braintree. Service between Harvard and Alewife began in 1983-84 with the opening of the Alewife extension. This 3.2 mile extension contains four new stations (including the rebuilt Harvard Station), with a 2,200 space parking garage at Alewife. All service operates along a common alignment between Alewife and the JFK/UMass Station in Dorchester, at which point service branches off to either Ashmont or Braintree. Throughout most of the day, service is split equally between the two branches. There are 216 cars in the Red Line fleet, over half of which were rebuilt in 1987 or delivered new in 1988.

Green Line The Green Line, which uses light rail vehicles (LRVs), also carries approximately 229,000 passenger trips per weekday. The Green Line has four branches to the west and southwest of downtown Boston: the

Figure 4-1
MBTA Rapid Transit Lines



Boston College branch (B Line), the Cleveland Circle branch (C Line), the Riverside branch (D Line) and the Arborway branch (E Line). All branches operate to their named terminals with the exception of the Arborway branch which now terminates at Heath Street near the V.A. Hospital. As further discussed below, service to Arborway was suspended due to construction activity, but restoration of full service to Forest Hills is now under consideration. The northern terminus of the Green Line is at Lechmere station in Cambridge, but only Heath Street/Arborway trains operate that far. Because ridership north of downtown Boston is much lower than to the west and southwest, Boston College and Riverside trains turn around at Government Center, and Cleveland Circle trains turn-around at North Station. There are approximately 220 LRVs in the Green Line fleet, including 100 Type-7 cars built in 1987-88, and approximately 120 Boeing LRVs built in 1976-77.

In addition, there is the Mattapan High Speed Line which operates between Ashmont and Mattapan using PCC light rail vehicles. Although the line can be considered as an extension of the Red Line in many respects, its vehicles are maintained and operated as part of the Green Line fleet.

Orange Line The Orange Line, which operates between Oak Grove in Malden and Forest Hills in Jamaica Plain, carries approximately 120,000 riders per weekday. In 1987, the southern end of the Orange Line between Chinatown and Forest Hills was relocated from an elevated structure along Washington Street to a new depressed alignment in the Southwest Corridor. This relocated segment is approximately 4.7 miles long with nine new stations. The line shares the right-of-way with commuter rail , which also use three of the eight stations. The Orange Line fleet consists of 120 vehicles, all of which were built in 1979 and 1980.

Blue Line The Blue Line is the shortest of the four lines and operates between Wonderland Station in Revere and Bowdoin Station in the Government Center area of Boston. Ridership on this line is approximately 45,000 per weekday. The Blue Line fleet consists of 70 cars which were built in 1979-80 at the same time as the Orange Line cars.

In addition to the new Orange Line and the Alewife extension, the MBTA has also recently completed station modernization and platform extensions on the Red and Orange Lines which has allowed an increase in the train lengths on these two lines from four to six cars. This increases potential peak hour capacity by 50 percent on these lines. (Planning has also begun to extend Blue Line platforms to accommodate six car trains.) With longer platforms, peak period vehicle levels have been increased to accommodate increasing ridership. Between FY 1986 and FY 1990, peak vehicle levels have been increased from 248 to 316 cars on the Red, Orange, and Blue Lines, and from

101 to 137 cars on the Green Line and Mattapan High Speed Line (see Table 4-1). Overall peak period frequency of service on these rapid transit and light rail lines ranges from 3.5 to 8 minutes.

Table 4-1
Rapid Transit and Light Rail Lines Peak Period Service Levels (FY 1990)

Line	Fleet Size (# Cars)	Trains	Consist (# Cars)	Cars	Headway (Minutes)
GREEN LINE	255	71	1 -3	133	1.3
Boston College		20	2	40	5
Cleveland Circle		14	2	28	6
Riverside Total		14	2,3	32	7
(two car trains)		10	2	20	
(three car trains)		4	3	12	
Reservoir		9	1	9	7
Heath Street		10	2	20	8
Run-As-Directed		4	1	4	
RED LINE	218	30	4, 6	150	4
Ashmont		7	4	28	8
		5	6	30	
Braintree		5	4	20	8
		9	6	54	
Run-As-Directed		1	4	4	
		3	6	18	
ORANGE LINE	120	17	6	102	4.5
BLUE LINE	70	15	4	60	3
MATTAPAN	12	6	1	6	4

Note: 1.3 minute Green Line headway is between Government Center and Copley, and 4 minute Red Line headway is between Alewife and JFK/UMass.

Major track improvements were recently completed on the Red and Green Lines, as well as power and signal improvements on the Green Line, in order to improve the reliability of those lines. Work has recently begun on a relocation of the Green Line between North Station and Lechmere to replace the current elevated service with subway service to provide cross platform connections with the Orange Line and improved connections with commuter rail at the new North Station.

Bus and Trackless Trolley

The MBTA operates 155 bus routes throughout the MBTA district, including trackless-trolley service in Cambridge, Watertown and Belmont. Nearly all routes connect with the rapid transit system at at least one location. In areas closer to Boston, bus service generally fills gaps in the rapid transit system (including crosstown service), provides feeder service to rapid transit stations, and provides line haul service in heavily congested areas. Further out, buses provide local service and connections to the rapid transit system. There are 1,026 buses in the MBTA's fleet (of which 473 are lift equipped) that provide nearly 7,200 trips on an average weekday.

Ridership on individual routes ranges from a high of 28,000 passenger trips per weekday on Route 39 (Arborway replacement service) and 12,000 per weekday on Route 29 (Mattapan to Ruggles) to a low of 90 passenger trips per weekday on Route 252 (South Weymouth to Braintree).[2] Total bus ridership in the Spring of 1989 was approximately 368,000 trips per weekday.

The present MBTA bus network consists mostly of routes taken over from several previous operators. Most of these routes have lengthy histories, and many had their origins as streetcar lines built before 1900. Although schedules and route alignments have been revised gradually over the years, these routes had not been comprehensively reviewed until the 1978 passenger count program and the subsequent corridor bus studies. However, although the MBTA has made changes to a number of routes based on those planning studies (also see "Service Planning" section, later in this section), most continue to operate along the same general alignments as they always have. A list of MBTA bus routes and FY 1989 service levels is shown below in Table 4-2.

Commuter Rail

The MBTA commuter rail network, shown in Figure 4-2, is comprised of 11 radial lines with 99 stations serving the Boston metropolitan area. Daily ridership currently exceeds 61,000 trips per day, with the large majority to and from Boston. The commuter rail system is split into two divisions – the Northern Division and the Southern Division. Northern Division service operates to and from North Station and Southern Division service operates to and from South Station. The Mass Turnpike can be considered the dividing line between North and South Station service: all routes north of the Mass Turnpike – the Rockport, Ipswich, Haverhill, Lowell, and Fitchburg lines operate to and from North Station. Lines along the Mass Turnpike or to

[2]For additional ridership information, see Chapter 5.

Table 4-2
MBTA Bus Routes and
FY 1989 Weekday Service Frequencies (in minutes)

Route #	Route Name	Rush Hours	Mid-day	Night
1	Harvard-Dudley Square	7/6	10	16
3	Boston Marine Industrial Park-Chinatown	20/22	-	-
5	City Point - McCormack Housing Project	-	60	-
6	Boston Marine Ind. Park-Haymarket & South Station	15	-	-
7	City Point-Downtown via Northern Avenue	12/14	25	40
8	Columbia Point-Ruggles Station via Edw. Everett Square	30	60	50
9	City Point-Copley Square via Broadway	8/9	15	30
10	City Point-Copley Square via Andrew & Southampton	25	35	60
11	City Point-Downtown	6/8	15	30
14	Roslindale Square-Dudley Square via Blue Hill Ave	60	60	60
15	Kane Square or Fields Corner-Ruggles via Uphams Corner	7/9	13	30
16	Forest Hills-UMass via Andrew	15/18	25	30
17	Fields Corner-Andrew or Ruggles Sta. via Geneva Avenue	12	20	L
18	Ashmont-Andrew via Dorchester Ave	60	60	-
19	Fields Corner-Ruggles via Warren Street & Grove Hall	13/20	-	-
20	Fields Corner-Neponset & Adams Belt Line	15	30	30
21	Ashmont-Forest Hills via Morton Street	9/15	45	40
22	Ashmont-Ruggles Station via Jackson Square	8	12	30
23	Ashmont-Ruggles Station via Washington	5/6	12	20
24	Wakefield Avenue-Mattapan	20/25	50	60
26	Ashmont-Norfolk & Morton Belt Line	15	30	30
27	Mattapan-Ashmont via River Street	30	30	30
28	Mattapan-Ruggles Station via Dudley Square	10	13	30
29	Mattapan-Ruggles Station via Jackson Square Station	5	10	20
30	Mattapan-Roslindale Square via Cummins Highway	20	30	60
32	Wolcott Sq.-Forest Hills via Cleary Sq./Hyde Park Ave.	12	15	30
33	Dedham Line-Mattapan via River Street	30	60	-
34	Walpole Ctr.-Forest Hills via Washington Street	18	30	60
35	Dedham Mall/Stimson-Forest Hills via Belgrade Ave	20/12	30	L
36	Charles River-Forest Hills	12	30	30
37	Baker & Vermont-Forest Hills Station via Centre Street	20/12	30	-
38	Wren Street-Forest Hills Station	20	40	L
39	Forest Hills-Copley via Huntington Ave & Back Bay Station	3	5	5
40	Georgetowne-Forest Hills	30/20	30	-
41	Centre & Eliot Streets-Dudley via Centre Street	20	34	L
42	Forest Hills-Ruggles Station via Wash St. & Dudley Square	15	20	50
43	Ruggles Station-Park & Tremont Streets via Tremont St	8	15	20
44	Franklin Park Zoo-Ruggles via Seaver St & Humboldt Ave	7	16	30

Table 4-2 (Continued)
MBTA Bus Routes and
FY 1989 Weekday Service Frequencies (in minutes)

Route #	Route Name	Rush Hours	Mid-day	Night
45	Franklin Park Zoo-Ruggles via Blue Hill Avenue	7	16	30
46	Heath Street & South Huntington Ave.-Dudley Square	30	30	-
47	Central Square, Cambridge-Andrew via Dudley Square	20/17	20	25
47A	Longwood Medical Area-BCH via Dudley Square	8/17	-	-
48	Centre & Eliot Sts./J. P. Loop via Jackson Sq./Green St.	-	30	-
49	Dudley Square-Downtown	6	10	13
50	Cleary Square-Forest Hills via Roslindale Square	20	60	-
51	Cleveland Circle-Forest Hills via Hancock Village	20	60	L
52	Dedham Mall/Charles River-Watertown Square via Oak Hill	30	30	-
53	Roberts-Newton Corner via Central Square, Waltham	30/60	60	-
54	Waverly Sq.-Newton Corner via Waltham Center	30/60	60	-
55	Queensberry-Copley Sq./Park & Tremont Sts. via Ipswich	17/30	30	30
56	Waltham Highlands-Newton Corner via Waltham Center	30/60	60	-
57	Watertown Square-Kenmore via Brighton Center	6	9	15
58	Auburndale-Newton Corner via Waltham Center	30	60	-
59	Needham Junction-Watertown Square via Newtonville	30	60	-
59A	Newton/Needham Line-Watertown Square via Needham St	L	60	-
60	Chestnut Hill-Kenmore via Brookline Village 17/18	28	45	
62	Bedford VA Hospital-Alewife via Lexington Center	30	60	L
64	Oak Square-Central Square, Cambridge	20	30	60
65	Brighton Center-Kenmore via Brookline Village	20/25	30	-
66	Union Square, Allston-Dudley Square via Brookline Village	8	14	30
67	Alewife -Alewife via Turkey Hill Reservation	25	45	-
69	Harvard-Lechmere via Cambridge Street	7/17	22/23	30
70	Cedarwood-Central Square, Cambridge via Watertown Square	20	22	60
71	Watertown Square-Harvard via Mt. Auburn Street	10	13	30
72	Huron Avenue-Harvard via Concord Avenue	15	30	30
73	Waverley Square-Harvard via Trapelo Road	4/5	13	30
74	Belmont Center-Harvard via Concord Avenue	15	35	60
76	Hanscom AFB-Alewife via Lexington Center	30	60	L
77	Arlington Heights-Harvard Station via Mass Ave	6	11	12
77A	North Cambridge-Harvard Station Local	9	13	-
78	Park Circle-Harvard Station via Blanchard Road	15	35	60
79	Arlington Heights-Alewife via Mass Ave	7/8	25	L
80	Arlington Center-Lechmere via Medford Hillside	15	35	60
83	Rindge Ave.-Central Square, Cambridge via Porter	8/15	30	60
85	Spring Hill-Kendall via Union Square, Somerville	40	40	-

Table 4-2 (Continued)
MBTA Bus Routes and
FY 1989 Weekday Service Frequencies (in minutes)

Route #	Route Name	Rush Hours	Mid-day	Night
86	Sullivan-Union Square, Allston via Harvard	18	30	60
87	Arlington Center-Lechmere via Clarendon Hill	16	25	30
88	Clarendon Hill-Lechmere via Highland Avenue	8/12	25	30
89	Clarendon Hill-Sullivan via Broadway	9	30	60
90	Davis Square-Wellington via Sullivan & Assembly Sq Mall	30/35	70	L
91	Sullivan-Central Square, Cambridge via Washington St	25	25	60
92	Assembly Square Mall-Downton via Sullivan & Haymarket	15/20	30	L
93	Sullivan-Downtown via Bunker Hill Street & Haymarket	6/10	20	30
94	Medford Square-Davis via West Medford	15	22	60
95	West Medford-Sullivan via Mystic Avenue	15	30	60
96	Medford Square-Harvard via Davis	15	30	60
97	Malden-Wellington via Commercial and Hancock Streets	30	60	-
99	Upper Highland Avenue-Wellington via Main Street	20	30	60
100	Elm Street-Wellington via Fellsway	20	20	60
101	Malden Station-Sullivan via Salem St, Main St, & Broadway	8/10	30	60
104	Malden Station-Sullivan via Ferry Street	12/15	30	60
105	Malden Station-Sullivan via Faulkner & Main Streets.	30	60	-
106	Lebanon Street, Malden-Wellington via Main Street	20	30	60
108	Linden Square-Wellington via Malden St & Highland Ave	20	30	60
109	Linden Square-Sullivan Squre via Broadway	12/15	30	60
110	Wonderland or Broadway/Park-Wellington via Park Ave	20	30	60
111	Woodlawn-Haymarket via Mystic Bridge & Tobin Bridge	5/6	15	30
112	Wellington-Maverick via Central Ave & Mystic Mall	40	40	-
116	Wonderland-Maverick via Revere Street	20	30	60
117	Wonderland-Maverick via Beach Street	20	30	60
119	Northgate-Beachmont via Revere Center	30	60	40
120	Orient Heights-Maverick via Bennington Street	14/15	20	60
121	Wood Island-Maverick via Lexington Street	30/25	-	-
130	Lebanon Street, Melrose-Malden Station via Forestdale	30	60	-
131	Melrose Highland-Malden Station via Oak Grove Station	30	60	-
134	North Woburn-Wellington via Medford Square	60	60	-
136	Reading Square-Malden Station via Lakeside & Oak Grove	30/45	60	L
137	Reading Square-Malden Station via North St & Oak Grove	30/45	60	-
210	Quincy Center-Fields Corner via North Quincy	30	30	-
211	Quincy Center-Squantum via North Quincy	30	60	-
212	Quincy Center-North Quincy via Billings Road	30/60	60	-
214	Quincy Center-Germantown via Sea Street & Oceanview	11/20	30	60

Table 4-2 (Continued)
MBTA Bus Routes and
FY 1989 Weekday Service Frequencies (in minutes)

Route #	Route Name	Rush Hours	Mid-day	Night
215	Quincy Center-Ashmont via East Milton Square	20/30	30	60
216	Quincy Center-Houghs Neck via Sea Street	9/20	30	60
217	Wollaston Beach-Ashmont via Wollaston	30	60	-
220	Quincy Center-Hingham	10/15	30	60
221	Fort Point-Quincy Center	L	-	-
222	Quincy Center-East Weymouth	10/15	30	60
225	Quincy Center-Weymouth Landing via Des Moines Road	20	60	60
225A	Quincy Center-Weymouth Landing via Quincy Avenue	20	60	-
230	Quincy Center-Brockton Line via Holbrook & Braintree Station	20	60	60
236	Quincy Center-South Shore Plaza via Braintree Station	30	60	-
238	Quincy Center-Crawford Square, Randolph via Quincy Adams	30	60	60
240	Avon-Ashmont via Randolph	20	60	60
245	Quincy Center-Mattapan via Quincy Hospital	30	60	-
252	South Weymouth-Braintree Station	45	-	-
300	Riverside-Downtown Express via Mass Pike	6/7	-	L
301	Brighton Center-Downtown Express via Oak Sq & Mass Pike	4/7	-	-
302	Watertown Square-Copley Square Express via Mass Pike	10/12	50	-
304	Watertown Square-Downtown Express via Mass Pike	8/10	30	-
304A	Newton Corner-Downtown Express via Mass Pike	8/10	30	-
305	Waltham Center-Downtown Express via Mass Pike	10	-	-
325	Elm Street, Medford-Haymarket Express via I-93	10/12	-	-
326	West Medford-Haymarket Express via I-93	10/15	-	-
350	Burlington/Billerica Line-Alewife via Arlington Center	12/20	60	60
352	Burlington-Haymarket or Park Square Express via 128 & I-93	10	-	-
353-	Burlington Industrial Area-Haymarket via Woburn Center	30	-	-
354	Woburn Center-Haymarket or Park Square Express via I-93	10/15	-	-
400	Lynn-Haymarket via Lynn Common	15	30	60
411	Malden Station-Revere House via Granada Highlands	45	60	-
426	Lynn & East Saugus-Haymarket Express via Cliftondale	10	60	80
429	Central Square, Lynn-North Saugus	30	60	-
430	Appleton St, Saugus-Malden Station via Saugus Center	30/45	60	-
433	Pine Hill-Central Square, Lynn	30/40	L	-
435	Lynn-Danvers via NS Shopping Center & Liberty Tree Mall	L	60	-
436	Happy Valley-Central Square, Lynn	30	60	-
437	Lake Shore-Central Square Lynn via Eastern Ave & Lake Side	30	60	-
	Central Square, Lynn-Nahant	30	L	-
	Lynn-Haymarket via Lynnway & General Edwards Bridge	10	30	60

Table 4-2 (Continued)
MBTA Bus Routes and
FY 1989 Weekday Service Frequencies (in minutes)

Route #	Route Name	Rush Hours	Mid-day	Night
441	Marblehead-Downtown via Paradise Rd & Central Square, Lynn	30	60	-
442	Marblehead-Downtown via Humphrey St & Central Sq, Lynn	30	60	60
450	Salem-Haymarket via Highland & Western Avenue	10	60	L
451	North Beverly-Salem	60	60	-
455	Salem-Haymarket via Central Square, Lynn	30	30	60
458 /468	Salem Center-Danvers via Liberty Tree Mall & Endicott Plaza	60	60	-

L=Limited Service

the south – the Framingham, Needham, Franklin, Attleboro/Providence, Stoughton, and Fairmount lines – operate to and from South Station. All Southern Division lines except the Fairmount Line also serve the Back Bay Station. For fiscal year 1990, the commuter rail fleet consists of 226 coaches and 24,228 seats. As shown in Table 4-3, a total of 183 peak weekday inbound and outbound trips are scheduled, with headways ranging from 25 to 40 minutes during peak periods and from one to four hours during off-peak times.

Between 1977 and 1986, the MBTA contracted for operation of commuter rail service from the Boston and Maine (B & M) Corporation. On January 1, 1987, the MBTA changed contractors from the B & M to Amtrak, which currently operates all MBTA commuter rail service. However, the MBTA owns all equipment and facilities, and nearly all of the track over which commuter rail service operates.

Since 1982, commuter rail ridership has increased by 77 percent. To accommodate this increased demand, the MBTA has added 9,500 commuter parking spaces and plans to construct an additional 1,933 spaces in 1989-90. Since 1983, the MBTA has also acquired 107 new rail cars and 26 locomotives. An additional 182 cars are now being delivered or are on order, and the purchase of 15 to 25 new locomotives is also planned.

Other recent changes to the MBTA commuter rail system include the restoration of service to Needham, the restoration of service to Fairmount, extension of the Franklin Line to Forge Park/I-495, and extension of the Attleboro Line to Providence, all of which occurred in 1987. There have also

Figure 4-2
MBTA Commuter Rail Lines

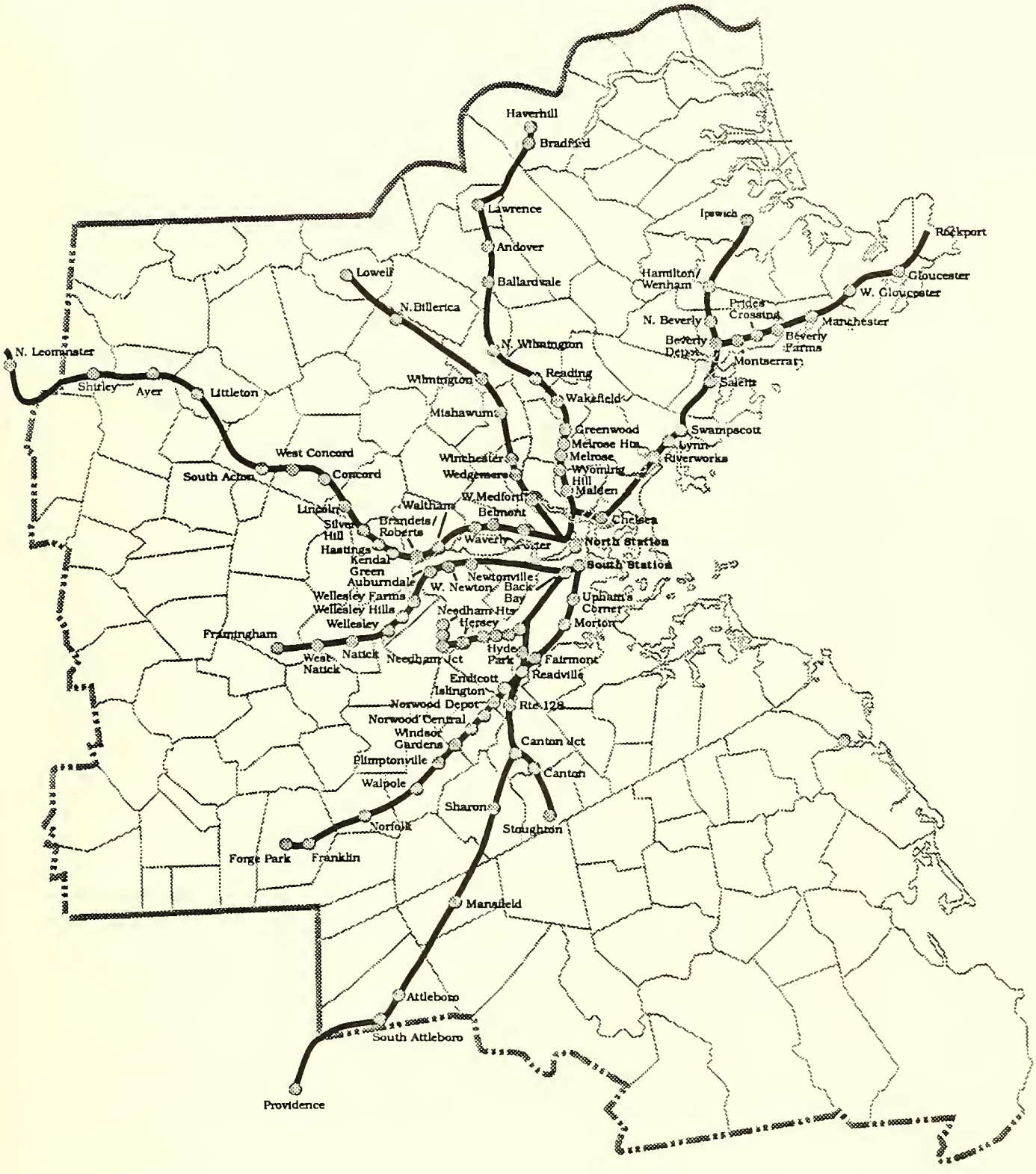


Table 4-3
Commuter Rail Service Levels

	Weekday Trips			Saturday	Sunday
	In	Out	Headways	Trips	Trips
NORTH SIDE SERVICE					
Fitchburg Line					
Peak	4	3	40 minutes	-	-
Off Peak	4	5	2 hours	-	-
Total	8	8		12	8
South Acton					
Peak	0	2	30 minutes	-	-
Off Peak	8	6	1 1/2 hours	-	-
Total	8	8		8	8
Lowell Line					
Peak	6	5	30 minutes	-	-
Off Peak	15	16	1 hour	-	-
Total	21	21		18	18
Haverhill Line					
Peak	4	3	25 minutes	-	-
Off Peak	5	6	2-3 hours	-	-
Total	9	9		8	8
Reading Line					
Peak	2	3	25 minutes	-	-
Off Peak	12	11	1 hour	-	-
Total	14	14		10	10
Ipswich Line					
Peak	4	3	30 minutes	-	-
Off Peak	9	10	2 hours	-	-
Total	13	13		14	-
Rockport Line					
Peak	3	4	30 minutes	-	-
Off Peak	9	8	2 hours	-	-
Total	12	12		16	-
NORTH SIDE TOTALS					
Peak	23	23	25-40 minutes	-	-
Off Peak	62	62	1-3 hours	-	-
Total	85	85		86	52

Table 4-3 (cont.)
Commuter Rail Service Levels

	Weekday Trips			Saturday	Sunday
	In	Out	Headways	Trips	Trips
SOUTH SIDE SERVICE					
Framingham Line					
Peak	4	4	30 minutes	-	-
Off Peak	10	11	2 hours	-	-
Total	14	15		-	-
Needham Line					
Peak	4	4	40 minutes	-	-
Off Peak	11	11	2 hours	-	-
Total	15	15		16	-
Franklin Line					
Peak	6	5	30 minutes	-	-
Off Peak	15	16	1 hour	-	-
Total	21	21		18	18
Attleboro Line					
Peak	4	3	25 minutes	-	-
Off Peak	5	6	2-3 hours	-	-
Total	9	9		8	8
Stoughton Line					
Peak	2	3	25 minutes	-	-
Off Peak	12	11	1 hour	-	-
Total	14	14		10	10
Fairmount Line					
Peak	4	3	30 minutes	-	-
Off Peak	9	10	2 hours	-	-
Total	13	13		14	-
SOUTH SIDE TOTALS					
Peak	24	22	25-40 minutes	-	-
Off Peak	64	65	1-3 hours	-	-
Total	88	87		66	36
NORTH & SOUTH SIDE TOTALS					
Peak	47	45	25-40 minutes	-	-
Off Peak	126	127	1-4 hours	-	-
Total	173	172		152	88

been substantial improvements to Lynn Station, North Station, South Station, and the commuter Rail services included in the Southwest Corridor. Studies are underway for the restoration of the Old Colony Rail line and rail extensions to Worcester, New Bedford, Fall River, and Newburyport. In addition, extensions are being considered to Nashua, New Hampshire, and to Maine.

Specialized Accessible Service

The MBTA provides three specialized accessible service programs: the RIDE, wheelchair-lift bus routes, and Call-a-Lift Bus. The RIDE service is a paratransit program that provides transportation to people who cannot use general public transportation because of physical or mental disability. The RIDE operates lift equipped vans which now serve 44 communities, as shown in Table 4-4. The Wheelchair-Lift program provides 100 percent lift-equipped buses on certain regularly scheduled bus routes. These routes are called "Lift Bus Routes" and are identified on scheduled cards with the international symbol for accessibility. The Call-a-Lift Bus program provides lift-equipped

Table 4-4
"The Ride" Service Area
(FY 1989)

Core Area				
Arlington	Belmont	Boston	Brookline	Cambridge
Chelsea	Everett	Malden	Medford	Melrose
Newton	Revere	Somerville	Watertown	Winthrop
Northwest Area				
Bedford	Burlington	Concord	Lexington	Lincoln
Waltham	Wilmington	Winchester	Woburn	
North Area				
Beverly	Danvers	Lynn	Marblehead	Nahant
Peabody	Salem	Saugus	Swampscott	
West Area				
Framingham	Natick			
South Area				
Braintree	Cohasset	Hingham	Holbrook	Hull
Milton	Quincy	Randolph	Weymouth	

buses upon request on routes where all scheduled buses are not wheelchair lift equipped.

The MBTA also operates approximately 700 "kneeling" buses which provide easier access for people who have trouble climbing stairs. In addition, all

trains on the Red, Orange, and Blue Lines are accessible to persons using wheelchairs, and are equipped with hand/grab rails and public address systems over which destinations and stops are announced. (However, not all stations are not accessible, but whenever significant work is done on a station, accessibility is upgraded.) The MBTA's light rail vehicles are not wheelchair accessible, but do provide highlighted stair edges, non-slip floors, hand/grab rails, priority seating decals, and public address systems like those used on the rapid transit system. The MBTA commuter rail system has 28 stations, including the new South Station which are wheelchair accessible. Five additional stations are scheduled to be made accessible in FY 1990, and North Station will be made accessible as part of the new North Station project (now underway). The most recently purchased commuter rail vehicles have designated wheelchair locations with two secured restraints in each commuter rail car.

Suburban Bus

Geared toward low density communities where regular MBTA service would not be cost-effective, the MBTA's Suburban Transportation Program provides funding and technical assistance to suburban communities that operate local transit services. This program, which began subsidizing bus service in 1979, now provides service to 12 communities in FY90 – Bedford, Beverly, Burlington, Dedham, Framingham, Lexington, Lynn, the Mission Hill neighborhood of Boston, Natick, Needham, Norwood, and Weymouth. Table 4-5 summarizes the current MBTA Suburban Bus Program.

Private Carrier Service

The MBTA contracts with private carriers who provide fixed route local service among destinations within the MBTA service district that are not otherwise directly served by other MBTA services. As shown in Table 4-6, six private carrier services were subsidized in FY 89.

Commuter Boat

The MBTA subsidizes commuter boat service from Hingham, on the South Shore, to Rowe's Wharf in downtown Boston. This service, which began in 1984, now consists of 20 daily round trips operated by two carriers, Boston Harbor Commuter Services and Mass Bay Lines.

As part of the traffic mitigation program for the Central Artery North Area Project (CANA), a water shuttle operating between the Charlestown Navy Yard and Long Wharf was recently initiated.

Table 4-5
FY 1990 Suburban Bus Service

Bedford	Lynn
•Local fixed route & demand response service •Shoppers service •One 12 passenger van	•Intra-town fixed route service shoppers service •One full size bus
Beverly	**Mission Hill Link**
•Local fixed route •Business district shoppers service •One 25 passenger bus	•Local fixed route service •Commuter link to MBTA Orange & Green Lines •Medical area service •One mini-bus
Burlington	**Natick**
•Local fixed route service •Commuter link to MBTA bus service at Burlington Mall •Shoppers service •Three mini-buses	•Intra-town fixed route & demand response service •Commuter link to MBTA commuter rail service & Peter Pan Bus Service •Commuter bus & Framingham World Mall •Shoppers service •Two mini-buses
Dedham	**Needham**
•Local fixed route service •Commuter link to MBTA bus service at Dedham Mall •Shoppers service •One full size bus	•Intra-town fixed route service •Commuter link to MBTA Commuter Rail service •Business district shoppers service •Two mini-buses
Framingham	**Norwood**
•Intra-town fixed route service •Commuter link to MBTA bus, commuter Rail & Natick Suburban •Bus service at Shoppers World Mall •One full size bus & three mini-buses	•Elderly & handicapped transport service •Intra-town demand response service •Taxi cabs & handicapped accessible vans
Lexington	**Weymouth**
•Intra-town fixed route service •Shoppers service •Four mini-buses	•Intra-town fixed route service •Commuter link to MBTA Red Line •Four mini-buses

Table 4-6
Private Carrier Services

	Service Description		
Service/Carrier	Weekdays	Saturday	Sunday
Quincy - Hull Andre Coachlines	6am - 10pm 10-30 minute headways	8am - 5:30pm 60 minute headways	8am - 5:30pm 60 minute headways (Memorial Day - Labor Day only)
Medford - Meadow Glen Mall Hudson Bus Lines	7:15am - 7:15pm 30 minute headways	7:15am - 7:15pm 30 minute headways	
Canton - Mattapan Station Hudson Bus Lines	6:30am - 6:30pm 60 minute headways	6:30am - 6:30pm 60 minute headways	
Salem & Peabody Local Service (Three Routes) Michaud Bus Lines	8:30am - 6:30pm 60 minute headways	8:30am - 6:30pm 60 minute headways	
Winthrop Local Service Rapid Transit, Inc.	5am - 1am 10-30 minute headways	5am - 1am 10-30 minute headways	7:25am - 11pm 30 minute headways
Hingham/Rockland/ Weymouth/Whitman - Boston Carey Bus Lines	6:05am - 6:35pm 5-55 minute headways		

SERVICE PLANNING

The MBTA makes service decisions based on a set of guidelines that have evolved from the 1977 "Service Policy for Surface Transportation."[3] The purpose of that document was "to establish a system of management policy that is prudent, effective, and responsive for use in guiding the operation and improvement of surface transit services within the MBTA district." More specifically, it was intended to provide:

(1) a uniform and effective basis for evaluating the relative costs, benefits, and overall performance of individual services,

(2) a responsive and effective methodology for establishing new services and improvements to existing services, and

(3) a consistent basis for determining the operating responsibility for individual services and supplemental financing arrangements for substandard services.

The "Service Policy for Surface Transportation" included service goals and objectives, service standards and guidelines with respect to service design and performance standards, and service planning and evaluation processes. Although the document only applied to surface transportation, it was intended at the time that it would also be expanded to rapid transit and commuter rail.

Following adoption of the policy, the MBTA embarked upon a systemwide passenger data collection program in 1978 in order to collect the data necessary to apply the standards and evaluation processes. This data collection effort involved counting riders on all of the rapid transit lines and each of its bus routes, and ridership surveys to provide a profile of MBTA riders by corridor.

The data collection results combined with the service standards did provide the MBTA with an objective method to compare the efficiency and effectiveness of individual services. As a result, it was effective in determining which routes were the least productive, but it did not provide enough information to determine why they were unproductive or how they could be improved. That type of determination required additional analysis, but because of the scope of the project (all of the MBTA rapid transit and bus system), the additional analysis could not always be completed in a timely manner.

In addition, once the standards were applied, it became evident that a large number of exceptions were required to satisfy social goals. For example,

[3] MBTA, "Service Policy for Surface Transportation," August 1977.

ındards were set that each route had to carry 30 passengers per vehicle hour d 2.5 passengers per vehicle mile during peak periods, unless 75 percent of riders were transit dependent or 15 percent or more of the ridership was 65 over. In those cases, the standards could be reduced to 20 passengers per ssenger hour and 1.5 passengers per vehicle mile. In some areas, certain ıtes that serve highly transit dependent and elderly riders could not meet ; reduced standards even with service cut back to minimum levels. ıwever, if there are no other transit alternatives in that area, and if the local nmunity concurred, the MBTA would continue to operate the route to intain a basic level of service.

a result of the original data collection and analysis efforts becoming rwhelming in scope, and the number of exceptions to service standards t resulted, the MBTA has made two fundamental changes in the way it luates its service. First, rather than to attempt to continue to evaluate all ıice continuously, the MBTA now focuses on specific geographical or rational areas for a more comprehensive analysis (although, as further ussed below, the MBTA does continue to monitor all service). Second, 1977 service standards are now treated as service planning "guidelines" or ectives" (as described later in this chapter).

Service Planning

MBTA now evaluates the effectiveness of its bus service mainly through use of "corridor studies". In these, the MBTA district has been split into corridors, and a comprehensive examination is made of each route in corridor. As part of each study, counts are conducted of the ridership on route, and the riders of each route are surveyed. This provides ridership mation by trip and by stop, reliability data, and rider profiles. This data is to evaluate service based on a number of factors:

Changes within the Corridor – changes to the employment and/or residential characteristics and accompanying travel patterns within the area served by each route.

Ridership Levels, including overall ridership and ridership by segment, transfers, and peak loads – what changes could be made to attract more ridership to all or part of each route.

Route Alignments, based on how well each route's alignment serves area residents and nearby trip attractors and generators. Changes examined include minor re-routings, route extensions, major changes that could significantly alter the character of a route, route combinations, and through-routing.

- Reliability, including on-time performance, at the beginning of and along the route, and its impact on transfers. Alternatives examined include changes to cycle times, deployment of additional vehicles, and holding strategies.

- Schedules, in terms of how schedule changes would impact route productivity, route coordination, passenger convenience and wait time, passenger loads, and travel times.

- Rapid Transit Connections – improving connections to rapid transit, including changes required as a result of changes to the rapid transit system, such as the Red Line extension to Alewife, and the new Orange Line.

The evaluation of these alternatives has included the evaluation of impacts on both the MBTA system and budgets and on its passengers, and includes an examination of each route in the corridor. Primary objectives have been to make bus service more responsive to user needs to attract new ridership, and to make service more cost-effective and efficient. The corridor studies began in 1983, and to date, seven corridors have been completed – South Shore, Central North, West, Northwest, Southwest, South, and North. The Central corridor study is underway, with the North Shore corridor to follow in the Fall of 1990. The bus studies are intended to be a continuous effort, with the examination of each corridor repeated every five to ten years. Follow-up work has since been done on certain South Shore, Northwest, Central North, and Southwest corridor routes, and once all corridors are completed, the MBTA plans to re-examine each corridor to determine whether subsequent changes are needed. The first corridors to be re-examined are expected to be the Northwest and Southwest corridors in order to determine the effectiveness of changes implemented in conjunction with the Alewife extension and the new Orange Line.

The MBTA believes that the corridor studies provide a better mechanism to evaluate service than the more broad-based effort that was attempted previously. The corridor studies allow for a more comprehensive examination of each route, and all routes, including those that perform well, are examined for ways to make them more productive. Previously, using performance standards to identify poorly performing routes, there was a tendency to only focus on those routes. Also, by providing a comprehensive data base, information collected as part of ongoing monitoring efforts can be used more effectively.

Other studies are also conducted to examine specific aspects of MBTA bus service. These include the Circumferential Transit Feasibility Study, which as its name implies, examined ways to improve circumferential, or crosstown

service, and the South Boston Piers Transit Study, which is examining the best way to provide service to projected development in South Boston.

In addition to these types of studies, the MBTA also analyzes all reasonable requests for service changes received from individuals, businesses, community groups and cities and towns. The MBTA receives this type of input through community outreach, direct contact from the public, its complaint system, and public hearings. The MBTA's response to and use of public input varies based upon the manner in which it is received and the purpose for which it is provided. In general, all input received through direct contact and the complaint system is given individual consideration and a direct response is made. When more broad-based input is sought, such as through community outreach and public hearings, direct responses are not provided, but consideration is given to all input.

In more detail, whenever a suggestion or complaint is received through direct contact with MBTA personnel or through the complaint system, the MBTA's Customer Relations staff investigates whether suggestions are feasible, or the circumstances resulting in the complaint, whichever is appropriate. In the case of complaints, the MBTA's response provides information on why the event occurred and on steps taken to prevent future occurrences, if applicable.

When suggestions relate to route or service level changes, an assessment is made of the cost, ridership, and operational impacts by the Service Committee. If the change is determined to be beneficial, or in many cases, if it can be implemented without significant adverse impacts, steps are then taken to implement the change and notification provided. If the change is rejected, a response is provided stating the reason the change will not be made. This process works as follows:

1. Upon initiation of a request for a significant service change – new routes, route extension, route deviations, through-routings, major changes in headways or level of service, from within the MBTA or from outside of the MBTA – Service Planning performs an initial review of the request.

2. The proposed service is presented to the "Service Committee," which consists of representatives of other departments affected by these types of changes and/or responsible for implementing them (see Table 4-7). The Service Committee reviews the change based on Service Planning's review and the input of the individual members. A recommendation is then made to the Deputy General Manager for Operations and the General Manager to either implement or reject the change. (Minor changes, such as small adjustments to headways, trip times, etc., are handled by the Schedule Department, without involvement of the

Service Committee, with changes approved directly by the Director of Operations.)

In addition to responding to suggestions and complaints, the MBTA routinely solicits public input as part of its normal planning activities and when planning service changes or capital improvements. One way in which this is done is periodic reviews of input received through the complaint system to determine areas where complaints are most frequent and where problems are starting to occur. A second method is solicitation of input from affected towns and community groups whenever changes are being considered (as in the bus corridor service studies and in making the system accessible to persons with disabilities and in connection with all capital improvements). The third method is through participation in community-based initiatives such as the recent Boston Transportation Department's Community Transit Workshops (which solicited neighborhood transit priorities and concerns).

Table 4-7
Service Committee Membership[4]

Voting Members
Manager of Service Planning (Chair)
Manager of Plans and Schedules
Manager of Traffic Operations
Assistant Superintendent of Surface Lines
Representative of Marketing & Ridership Department
A Surface Line Instructor

Also, public hearings are held at various stages in the planning process. These are held based on the MBTA's own public notification policies and in accordance with state and federal laws and regulations. These include public hearings that precede major changes to route alignments, hours of service, or the days on which service is provided. They also include the public hearings that preceded the fare increase, that precede applications for federal funding, and that have been held with respect to replacement service along Washington Street, the Watertown Trolley line, and along the Arborway line, the South Boston Piers Access, and the Bowdoin Charles Connector.

[4]There are also several non-voting members who attend meetings as appropriate to agenda items including the Chief Planning Officer, Marketing Staff, Service Planning Staff, and Community Affairs Staff.

Rapid Transit and Commuter Rail Planning

The operation of the rapid transit and commuter rail systems is more labor intensive than the operation of bus routes and there are far fewer routes. As a result, operational problems and future needs are more readily apparent on the these services than on individual bus routes. Also, because ridership is so high on each of the rapid transit lines, the MBTA receives a large amount of public input with respect to rapid transit service.

Due to these factors, rather than conduct ongoing studies of rapid transit and commuter rail operations, as is done with bus service, the MBTA relies on its operating personnel, the communities it serves, and its riders, in conjunction with its planning personnel, to identify specific aspects of rapid transit service for further examination. Public input is obtained in the same basic manner as for bus projects with public hearings are held based on the MBTA's own public notification policies and in accordance with state and federal laws and regulations.

A number of studies are underway or have recently been completed which consider operating improvements, parking expansion, additional seating capacity, and different modes of service along particular routes:

Rapid Transit Parking Expansion Parking shortages now exist at most rapid transit stations, thus limiting assess to the system. At present, there are approximately 17,000 parking spaces at and around rapid transit stations, while preliminary estimates prepared for the MBTA indicate that there is currently demand for an additional 14,000 spaces. By 2010, demand is expected to grow by an additional 11,000 spaces.

The MBTA is currently in the process of finalizing parking demand estimates for the rapid transit system, and determining where parking expansion is feasible and how it can be accomplished (expansion of surface lots, and/or construction or expansion of parking garages). Currently proposed locations for parking expansion include Braintree, Quincy Adams, Beachmont, Orient Heights, Wonderland, Waban, Sullivan Square, Oak Grove, Malden and Woodland.

Commuter Rail Parking Expansion As with rapid transit, parking shortages also exist at most commuter rail stations. Total parking demand has been estimated for each corridor, and for certain station groupings; estimated for specific stations are now being developed. These estimates indicate a need for up to 29,000 additional spaces. For FY 1990, construction of an additional 3,400 spaces is planned, with additional expansion beyond that time.

Rapid Transit Capacity Expansion To reduce overcrowding on the Orange and Red Lines, platforms have been extended to allow the operation of six-car trains. Planning is now underway to accomplish the same on the Blue Line. In addition, more rush hour trains have been added to the Boston College and Riverside branches of the Green Line. Projects are also underway to upgrade the Green Line power system to allow operation of three car trains, and to develop a simulation model of Green Line operations in order to determine additional measures to improve Green Line service.

Commuter Rail Capacity Expansion With continued increases in commuter rail ridership, the MBTA continues to expand the commuter rail fleet. The MBTA is currently taking delivery of an additional 107 single level commuter rail coaches, and 24 bi-level coaches have been ordered.

Arborway Corridor Transit Study - In December 1985, light rail service on the Arborway Line, which serves primarily the Jamaica Plain and Mission Hill sections of Boston, was suspended due to several construction projects, including the reconstruction of Huntington Avenue. It was restored to Brigham Circle in July 1985 and to Heath Street in November 1989. Substitute bus service has been provided using the Route 39 bus. During this period, the MBTA undertook the Arborway Transit Study to examine different modes of service to this area, recognizing the proximity of the new Southwest Corridor, and the difficulties of maintaining consistent operations with mixed traffic service. The alternatives under study included several combinations of bus and rail service. Full restoration of the line depends on the reconstruction of South Street to Forest Hills (now under design) and the resolution of the Green Line accessibility issues, as well as financing.

Washington Street Replacement Service - With the opening of the Southwest Corridor in May 1987, rapid transit service on the elevated track between the portal south of Essex Street and Forest Hills was discontinued. High frequency substitute bus service has been provided using the Route 49 bus between Dudley and downtown Boston. To plan for the replacement service along Washington Street, the MBTA initiated an Urban Mass Transportation Administration (UMTA) Alternatives Analysis/Draft Environmental Impact Statement study of several technologies, including light rail transit, trackless trolleys, and buses. The MBTA is proposing an ultimate system of electric buses to be tied into the South Boston Piers access system, and a surface bus with a free transfer at Tufts/New England Medical Center in the interim.

Watertown Trolley Analysis - The "A" Route of the Green Line light rail transit system from Watertown to Park Street subway station in Boston

was replaced in 1969 by a bus line (Route 57) from Watertown to Kenmore Square. The "A" Line infrastructure has remained intact for access to the Watertown maintenance facility. The MBTA initiated the Watertown Trolley Study in 1985 to determine whether the "A" Line trolley service should be restored or if buses should continue to provide the service on the line. A draft final study report was issued in 1987. Based on the findings, community reaction and available funding, the MBTA plans to retain the current bus service rather than restore trolley service.

Bowdoin - Charles Connector The MBTA is currently studying an extension of the Blue Line from its terminus at Bowdoin to Charles Station on the Red Line. The extension would provide a connection between the Blue and Red Lines, which are the only two lines where direct transfers are not now possible. The MBTA has applied to UMTA to proceed with an Alternatives Analysis/Draft Environmental Impact Statement on this project.

Circumferential Transit Feasibility Study The MBTA is examining a number of transit options to serve increasing "circumferential" travel throughout the Boston area to and from areas such as the Longwood Medical area, Logan Airport, UMass Boston, as well as crosstown trips between Somerville, Cambridge and Boston. Alternatives under consideration include expansion of bus service as well as new rail lines. A draft report is currently being prepared.

South Boston Piers/Fort Point Channel Transit Alternatives A number of large-scale office, industrial and residential developments are planned for the South Boston Piers/Fort Point Channel. This study is being conducted to determine how to best provide transit service to serve these developments. Alternatives under examination include at-grade light rail, an underground transitway using buses, LRVs, or automated vehicles, a Red Line loop, as well as transportation system management (TSM) options. A draft Environmental Impact Report has been completed, and work is continuing to determine a preferred alternative.

Old Colony Line Commuter Rail Restoration The MBTA is currently planning to restore "Old Colony" commuter rail service, which was discontinued in 1959, to southeastern Massachusetts. Partial service is scheduled to begin in 1992.

Commuter Rail Extensions Extension of commuter rail service along a number of lines is currently under consideration. These include extension of the Ipswich Line to Newburyport, extension of the Lowell Line to Tyngsboro or Nashua, New Hampshire, the extension of the Framingham Line to Worcester, Milford or Marlboro, the Franklin Line to

Bellingham, and the Stoughton Line to Taunton and Fall River and/or New Bedford.

New North Station Preliminary stages of construction are now beginning for the new North Station. As part of this project, commuter rail platforms will be raised, the Green Line will be relocated into a subway, and a new Green and Orange Line station will be constructed to provide improved connection with commuter rail, and cross platform connections between the Orange and Green Lines.

SERVICE AND PERFORMANCE GUIDELINES

When existing services are reviewed as part of various studies (such as the corridor bus studies), or when requests for service changes are received from public officials or riders, a general set of design and performance guidelines are used. These guidelines, which are the outgrowth of the planning efforts of the late 1970's, are intended to ensure that service is made as attractive as possible, and operates reliably throughout the district.

As discussed above, the operating and performance guidelines were originally designed to compare services throughout the district in order to provide a basis on which to ensure that overall service is distributed equitably and is cost-effective. In practice, individual goals often conflict with each other, so that judgement must used to decide which should prevail in particular instances. For example, standards intended to ensure that service is of high quality can conflict with standards related to cost containment. The guidelines now used by the MBTA to evaluate changes to existing service or proposed new service are described below.

Performance Measures

Existing bus routes should carry at least 30 passengers per revenue vehicle hour in each time period, and at least 2.5 passengers per passenger mile during peak periods, and 1.5 passenger per mile during off-peak periods. However, if 75 percent or more of the average daily ridership of a service is transit dependent (as defined as not having an automobile available for the trip), or more than 15 percent are elderly and handicapped, then the standards are reduced to 20 passengers per hour, 2.5 passengers per mile during peak periods, and 1.0 passengers per mile during off-peak periods.

Most MBTA bus routes easily exceed these guidelines. Most exceptions that occur are weekend service on routes that serve heavily transit dependent populations, or are the only route in the area and for which service cannot be reduced any further (usually because only one vehicle is deployed on the route).

For new service, initial projected demand should be at least 25 passengers per vehicle hour and 2.0 passenger per vehicle mile. After approximately six months, the new service should be able to attain the normal guidelines.

On-Time Performance

On-time performance measures are based on minimum percentages of trips that should depart as scheduled. "On-time" is defined as no more than five minutes after the scheduled time, and no trips should leave early. The guidelines, which vary depending on the headway, are shown below in Table 4-8. There are no specific guidelines for on-time arrivals at intermediate points or at the terminal, but service is scheduled so that routes should be able maintain their schedules.

On-time performance is measured and evaluated as part of each bus study. More recently, layover time at the end of the route has been scheduled to be no less than 1.5 times the standard deviation of the average trip time. Statistically, this should yield on-time departure performance levels of 92 percent. However, as a practical matter, possible combinations of headways and running times usually result in longer than minimum layover times, which result in higher levels of on-time performance.

Table 4-8
On-Time Performance Guidelines
(Minimum Percent of On-Time Departures)

	Headway	
	Less than 10 Minutes	Over 10 Minutes
All Service	80%	95%

In the bus service studies conducted by CTPS, measured on-time performance levels have been very high, with few instances of on-time performance below 90 percent.

Layover Time

Layover time, or recovery time, is the time that a trip "lays over" at the end of one trip before beginning the the next trip. It is built into schedules to "recover" time that may be lost on one trip to prevent late arrivals from carrying over to subsequent trips as late departures. Layover time optimally should be approximately 20 percent of the one-way running time. However,

if required to maintain on-time performance due to high running time variability, layover times of greater than 20 percent will be scheduled.

Route Layout

The alignment of routes should be as direct as possible, avoiding circuitous paths and undeveloped land. Deviations from the basic alignment should be minimized.

Service is operated only over asphalt or concrete paved streets having at least 10 foot lanes. Safety considerations prevail in the final determination. In addition, service will not be operated over streets which continually exhibit danger producing situations, such as steep grades; poorly plowed and/or sanded roadways; or streets where illegal parking habitually encroaches upon the roadway, reducing passage to less than 10 feet.

Frequency of Service/Load Factors

For most routes, headways are based on loading standards which set the maximum load that should be carried at any point along the route (see Table 4-9), which is termed the peak load. For bus service, demand-based headways are then a function of the loading standards and peak loads; for rapid transit service, they are a function of the loading standards, peak loads, and train length. In addition, where headways exceed 10 minutes, they are set to correspond with clock-face values to the maximum extent practicable.

Table 4-9
Bus & Trackless Trolley Maximum Load Standards
(as a percent of seated capacity)

	Peak 30 Minutes	Total Peak Period	Midday Period	Evening Period
Express Bus	NS[5]	NS	NS	NS
All Other	140%	120%	100%	100%

[5]NS=No Standees. Service should be scheduled to yield average load factors of less than 100% to allow excess capacity for ridership growth and because of generally longer travel time on this service. However, in practice, due to budgetary constraints, this standard is rarely achieved. In the recent past, rather than adding service to certain routes to achieve no standees, it has instead been added to other routes to reduce crowding.

On rapid transit, peak loads usually occur at one of the four major downtown transfer stations (Downtown Crossing, Park, State and Government Center). On express bus, rapid transit, feeder bus and commuter rail services, the peak ridership loads, generally occur between the last inbound stop and the first Boston central business district (CBD) stop. On line haul and cross town bus services, the maximum load point usually occurs at some point in the middle of the route. The MBTA loading standards for rapid transit are shown below in Table 4-10.

Table 4-10
Rapid Transit Maximum Load Standards
(number of passengers per car)

	Peak Periods	Off-Peak Periods
Green Line	130	70
Red Line	190	100
Orange Line	155	80
Blue Line	110	55

As a practical matter, rapid transit service is capacity constrained during peak periods, with all equipment used and loading standards often exceeded. During off-peak periods, there is a minimum train length of two cars on the Red, Orange and Blue Lines, but due to operational considerations, longer trains are usually operated and loads are lighter.

In instances where passenger loads are so light as to require excessive headways between trips to comply with loading standards, policy headways are used instead to ensure that a basic level of service is provided. The policy headways to be used for rapid transit, and bus services are shown below in Table 4-11.

Directness of Service

Directness of service, which affects both ridership and productivity, can be measured in terms of transfer activity. Productivity, in terms of cost per rider, can be increased by requiring a high percentage of transfers because a larger area can be served with fewer buses. However, ridership is usually adversely affected because the inconvenience of making a transfer discourages a certain number of potential riders from making the trip by transit. In addition, the MBTA fare structure, which does not provide for free or discounted transfers for cash fares, further discourages potential ridership by charging two fares for

Table 4-11
Policy Headways (Minutes)

	Peak	Midday	Evening
Rapid Transit			
Green Line	NA	10	10
Red, Blue & Orange Lines	NA	12	13
Bus, Trackless Trolley, and Surface Streetcar Service			
All Service	30	60	60

trips that would cost only one fare if a transfer were not involved. Therefore, increases in transfer activity must be balanced against potential ridership losses. In these respects, the following standards apply:

- No more than 25 percent of those customers using only surface services should require more than one vehicle to complete their trip by surface transit.

- Where transfers are required, through-routing of service is desirable. However, the linking of routes to correspond with travel patterns must consider schedule ramifications (although not necessarily be controlled by them), including turn-back points, operator relief points and schedule adherence. As a general guideline, the MBTA will attempt to through-route two infrequent services rather than two frequent services. Further, nothing is intended to preclude the linking of two routes in off-peak hours when they are not linked during peak hours.

- When two separate routes having a common terminal exhibit an average transfer rate where 20 percent or more of all passengers transfer between the routes, then the two routes become candidates for combining the two routes into one through-route. Additional qualifications for combining routes are (1) the two routes should serve travel corridors which are located approximately on opposite sides of the terminal, (2) the frequencies of service and the hours of operation must be similar, (3) the two routes should be stable and well established (since once they are combined, service on one cannot be modified without affecting service on the other), and (4) the combined round trip running time of the two routes should not exceed 4 hours.

- Scheduled leave/arrive times for routes having common terminals should be coordinated to the maximum extent practicable.

- Route extensions of one mile or less should be implemented if that extension would eliminate the need to transfer for 20 percent or more of that route's passengers.

- Feeder bus service should be scheduled to meet the first and last rapid transit trains where warranted.

Passenger Stops

There are a number of criteria used in establishing bus stops along routes. In general, they involve spacing between stops and the amount of space required at the stop.

In residential areas, bus and trackless trolley stops should be spaced at a maximum of eight per mile, while in commercial areas, they should be spaced at a maximum of 12 per mile. All stops should be delineated by at least a sign on a stanchion or on a utility pole. The preferred delineation will also include pavement markings that show the limits of the stop and the words "Bus Stop" or "Trolley Stop."

The minimum acceptable lengths for bus and trolley bus stops is 60 feet for stops, located at the far side of intersections, and 80 feet for nearside and mid-block stops. Because it is easier for buses to maneuver into farside stops and less distance is required, farside stops are preferred. Multiple lengths at stops are required when the combined headway of routes using the stops is 5 minutes or less or the stop is a layover point. Exceptions to the above criteria are made particularly through the addition of stops to accommodate the elderly or persons with disabilities. In addition, permits for stop locations are required from individual communities.

Passenger Shelters

The placement of shelters is based on three major factors:

(1) The number of boardings and/or transferring passengers at a specific stop. Bus stops which serve at least 100 boardings and/or transfer passengers during the course of a typical weekday are normally potential sites for shelter installations.
(2) The percentage of elderly and handicapped persons using routes which extend beyond the stop.
(3) The feasibility of installing a shelter based on site specific physical limitations and easements.

5. MBTA Service and Ridership: Trends and Projections

RIDERSHIP TRENDS

Rapid Transit, Surface Green Line and Bus Transit

Between CY 1983[6] and FY 1989, estimated average weekday ridership on the MBTA rapid transit, surface Green Line and bus services has increased nearly 17 percent from 749,300 to 873,225 trips per weekday (see Figure 5-1).[7] The large majority of this increase was on the rapid transit system (excluding the surface Green Line), where ridership during the same period increased by 30 percent from 326,500 to 423,600 weekday trips. During the same period, surface trips (which includes buses, trackless trolleys, and the surface Green Line) increased only 3 percent from 422,800 trips to 436,000 trips per weekday. Also, while rapid transit ridership continues to increase significantly, surface ridership appears to have leveled off and has recently showed small declines.

Higher growth on the rapid transit system has been the result of a number of large improvements that have been made since 1982:

- The Red Line extension to Alewife that included new stations at Davis Square, Porter Square, and Alewife, as well as a new Harvard Station.
- The relocation of the Orange Line in the Southwest Corridor.
- Track rehabilitation, power system improvements, and new signal systems to improve reliability.
- 158 new rapid transit and light rail vehicles to replace old vehicles and to expand capacity.
- Station modernization at Central, Kendall, JFK/UMass, Park (Red Line), Downtown Crossing (Red and Orange Lines), State (Orange Line), and Chinatown. In addition, station modernization is nearing completion at South Station, Broadway, and Andrew.
- Parking expansion.

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[6]This report examines the period since the 1981-82 fare changes. Therefore, 1983, which was the first full year following those changes, is used as a base for ridership figures.

[7]In unlinked trips. An unlinked trip is counted every time a person enters a transit vehicle (except for rapid transit-to-rapid transit transfer trips). Linked trips do not consider the number of transfers made. For example, a trip from Cambridge to Boston using bus Route 73 to Harvard to the Red Line would be counted as one linked trip and two unlinked trips.

These improvements have both attracted new riders and caused a shift from bus to rapid transit service. For example, by the Fall of 1986, the Alewife extension had increased rapid transit ridership by 19,900 trips per weekday, but caused bus ridership to decline by 7,300 trips per weekday (see Tables 5-1 and 5-2). In addition, since 1983, the amount of rapid transit and Green Line service provided has increased from 17.6 million vehicle miles to 20.1 million in FY 1990, an increase of 14 percent. Service level increases have been implemented to respond to increased ridership, to reduce crowding, and to encourage future growth.

On the bus system, improvements have been more modest. Some new routes were implemented to serve the Red Line extension to Alewife and to replace Orange Line service in the Washington Street corridor in Roxbury, while two express routes were eliminated when Needham commuter rail service was restored. In addition, 580 new buses were purchased, which significantly upgraded the bus fleet and improved reliability. Overall, the MBTA operated 155 bus routes in 1989 compared to 156 in 1983. However, although one fewer route is operated, the number of vehicles miles increased by 10 percent from 23.7 to 26.0 million vehicle miles.

As previously stated, average weekday and annual rapid transit and surface ridership is presented in Tables 5-1 and 5-2. In addition, weekday boardings by rapid transit station are presented in Figure 5-2 and recent estimates of daily

Figure 5-1
MBTA Weekday Ridership Trends

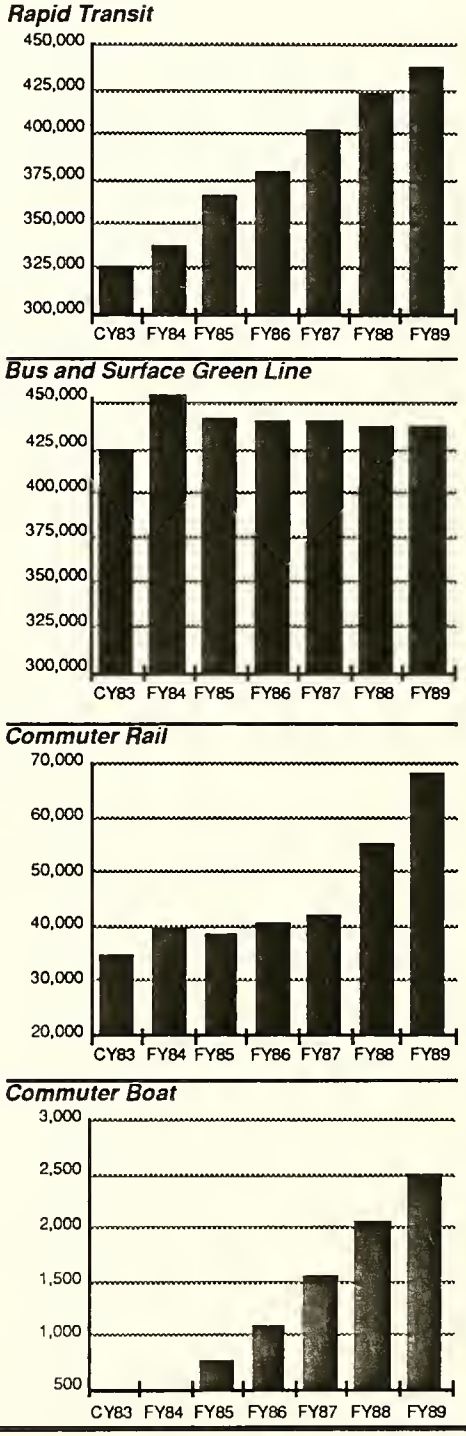


Table 5-1
Annual Rapid Transit and Surface Ridership

	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989
Rapid Transit	95,173,000	98,696,200	106,969,700	109,165,800	117,538,500	124,409,500	127,775,000
Surface	123,378,000	130,320,300	129,399,900	126,298,800	128,711,500	127,971,100	127,426,200
Total Unlinked Trips	218,551,000	229,016,500	236,369,600	235,464,600	246,250,000	252,380,600	255,201,200
Percent Increase		4.8%	3.2%	-0.4%	4.6%	2.5%	1.1%
Total Linked Trips	150,619,200	156,758,400	162,484,400	163,462,400	169,015,900	174,050,434	175,715,500
Percent Increase		4.1%	3.7%	0.6%	3.4%	3.0%	1.0%

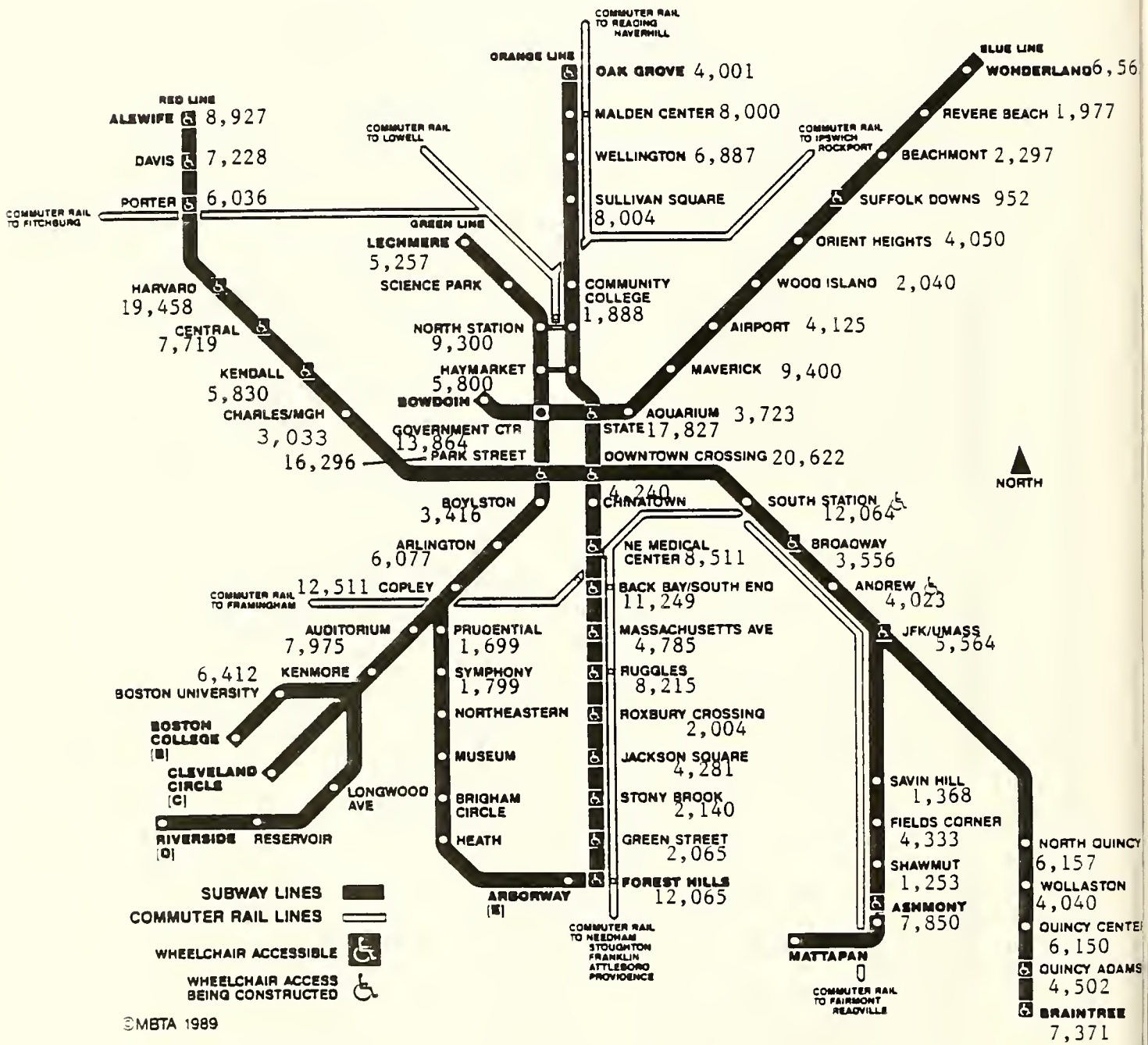
Source: MBTA Operations Directorate Planning Division, "Ridership and Service Statistics", January 1990

Table 5-2
Average Weekday Rapid Transit and Surface Ridership

	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989
Rapid Transit	326,542	338,192	364,775	378,817	401,542	423,625	437,108
Surface	422,800	453,233	441,642	439,542	439,992	435,958	436,117
Total Unlinked Trips	749,342	791,425	806,417	818,359	841,534	859,583	873,225
Percent Increase		5.6%	1.9%	1.5%	2.8%	2.1%	1.6%
Total Linked Trips	517,675	535,642	553,817	558,917	577,567	592,667	600,892
		3.5%	3.4%	0.9%	3.3%	2.6%	1.4%

Source: MBTA Operations Directorate Planning Division, "Ridership and Service Statistics", January 1990

Figure 5-2
Average Weekday Rapid Transit Boardings by Station
(April 1989)



bus ridership by route is presented in Table 5-3. Note that the estimates presented in these tables and figures have been derived by the MBTA using different methods. The average weekday and annual ridership estimates (Tables 5-1 and 5-2) were derived using a revenue-based procedure similar to that used to estimate the ridership impacts of the 1989 fare increase (see Chapter 7) and are the most accurate available. Daily rapid transit boarding estimates in April 1989 (Figure 5-2) represent passengers entering stations and do not include transfers. They are based upon revenue collected for one day and turnstile readings for one day for all stations. As described in Chapter 7, these counts often understate actual ridership. The weekday bus ridership estimates (Table 5-3) are the most recent available on a route-by-route basis. Most route level estimates are based on ridechecks performed as part of bus corridor studies conducted between 1984 and 1986, and many have not been updated to 1989.

Commuter Rail

Commuter rail ridership increased 56 percent between 1983 and 1988 from approximately 11.3 million annual trips to 17.8 million annual trips, with the largest increases occurring since 1986 (see Tables 5-4 and 5-5 and Figure 5-2).[8] The large increases in ridership since 1986 are attributable to a number of factors. In 1984, fires destroyed two commuter rail bridges: the North Station Bridge and the Beverly Drawbridge. The North Station bridge fire meant that all North Side service had to terminate on the north side of the Charles River, requiring passengers to transfer from there to North Station by bus shuttle, which added 10 minutes to trip times. The Beverly bridge required service on the Rockport and Ipswich Lines north of Salem to be replaced with shuttle buses to and from Salem. In 1986, there was a three month commuter rail strike that required some service to be replaced with shuttle bus service for up to three months. Also, until 1987, the MBTA did not have enough equipment to meet demand, and much of the existing rolling stock was old and unreliable. Beginning in 1987, the MBTA began placing new commuter rail coaches into service that improved reliability, comfort and capacity. These improvements have resulted in the large increases since 1986.

Other than the 1986 strike, South Side service did not experience major disruptions to service as did North Side service. Also, the MBTA had deployed its newer rolling stock on the South Side so that equipment problems did not impact South Side ridership as greatly as on the North Side. As a result, South Side service showed greater increases between 1982 and 1986 than did North Side service. Since 1986, South Side ridership has also

[8]Ridership in Tables 5-4 and 5-5 are based on commuter rail conductor headcounts. As discussed in Chapter 5, these estimates tend to overestimate ridership, but are reliable for use in examining trends. Figures in Figure 5-3 are based on a one day count and are more representative of actual ridership.

Table 5-3
MBTA Weekday Bus Ridership[9]

Route #	Route Name	Weekday Boardings
1	Harvard-Dudley Square	15,860
3	Boston Marine Industrial Park-Chinatown	350
5	City Point - McCormack Housing Project	309
6	Boston Marine Ind. Park-Haymarket & South Station	1,020
7	City Point-Downtown via Northern Avenue	2,930
8	Columbia Point-Ruggles Station via Edw. Everett Square	1,260
9	City Point-Copley Square via Broadway	4,300
10	City Point-Copley Square via Andrew & Southampton	1,560
11	City Point-Downtown	4,850
14	Roslindale Square-Dudley Square via Blue Hill Avenue	580
15	Kane Square or Fields Corner-Ruggles via Uphams Corner	5,420
16	Forest Hills-UMass via Andrew & Franklin Park Zoo	2,520
17	Fields Corner-Andrew or Ruggles via Geneva Avenue	3,810
18	Ashmont-Andrew via Dorchester Avenue	650
19	Fields Corner-Ruggles via Warren Street & Grove Hall	1,250
20	Fields Corner-Neponset & Adams Belt Line	1,780
21	Ashmont-Forest Hills via Morton Street	2,190
22	Ashmont-Ruggles via Talbot Ave & Jackson Square	5,410
23	Ashmont-Ruggles via Warren Ave	10,750
24	Wakefield Avenue-Mattapan	1,520
26	Ashmont-Norfolk & Morton Belt Line	1,830
27	Mattapan-Ashmont via River Street	710
28	Mattapan-Ruggles via Dudley Square	7,120
29	Mattapan-Ruggles via Jackson Square Station	12,140
30	Mattapan-Roslindale Square via Cummins Highway	2,160
32	Wolcott Square-Forest Hills via Cleary Square	5,540
33	Dedham Line-Mattapan via River Street	1,030
34	Walpole Center-Forest Hills via Washington Street	6,650
35	Dedham Mall/Stimson Street-Forest Hills via Belgrade Ave	2,360
36	Charles River Loop-Forest Hills	3,250
37	Baker & Vermont Streets-Forest Hills via Centre Street	1,850
38	Wren Street-Forest Hills	980
39	Forest Hills-Copley via Huntington Avenue & Back Bay Station	28,000
40	Georgetowne-Forest Hills	1,190
41	Centre & Eliot Streets-Dudley via Centre Street	1,420

[9]Ridership figures indicate the last route specific estimates that were made for that route. Most are since 1986, but have not been updated to 1989.

Table 5-3
MBTA Weekday Bus Ridership
(Continued)

Route #	Route Name	Weekday Boardings
42	Forest Hills-Ruggles via Washington St & Dudley Square	1,740
43	Ruggles-Park & Tremont Streets via Tremont St	9,200
44	Franklin Park Zoo-Ruggles via Seaver St. & Humboldt Ave.	4,820
45	Franklin Park Zoo-Ruggles via Blue Hill Avenue	4,620
46	Heath Street & South Huntington Ave-Dudley Square	640
47	Central Square, Cambridge-Andrew via Dudley Square	5,730
47A	Longwood Medical Area-Boston City Hospital via Dudley Square	2,030
48	Centre & Eliot Sts/J. P. Loop via Jackson Square & Green Street	270
49	Dudley Square-Downtown	5,580
50	Cleary Square-Forest Hills via Roslindale Square	1,190
51	Cleveland Circle-Forest Hills via Hancock Village	1,880
52	Dedham Mall/Charles River-Watertown Square via Oak Hill	1,340
53	Roberts-Newton Corner via Waltham Center	830
54	Waverly Square-Newton Corner via Waltham Center	650
55	Queensberry-Copley Square/Park & Tremont Streets	1,320
56	Waltham Highlands-Newton Corner via Waltham Center	580
57	Watertown Square-Kenmore via Brighton Center	9,940
58	Auburndale-Newton Corner via Waltham Center	390
59	Needham Junction-Watertown Square via Newtonville	970
59A	Needham/Newton Line-Watertown Square via Newtonville	200
60	Chestnut Hill-Kenmore via Brookline Village	2,370
62	Bedford VA Hospital-Alewife via Lexington Center	960
64	Oak Square-Central Square, Cambridge	1,540
65	Brighton Center-Kenmore via Brookline Village	1,900
66	Union Square, Allston-Dudley via Brookline Village	9,150
67	Alewife-Alewife via Turkey Hill Reservation	600
69	Harvard-Lechmere via Cambridge Street	3,390
70	Cedarwood-Central Square, Cambridge via Watertown Square	5,900
71	Watertown Square-Harvard via Mt Auburn Street	5,400
72	Huron Avenue-Harvard via Concord Avenue	1,580
73	Waverley Square-Harvard via Trapelo Road	5,830
74	Belmont Center-Harvard via Concord Avenue	2,130
76	Hanscom AFB-Alewife via Lexington Center	1,020
77	Arlington Heights-Harvard Station via Mass Ave	6,720
77A	North Cambridge-Harvard	1,120
78	Park Circle-Harvard via Blanchard Road	2,090
79	Arlington Heights-Alewife via Mass Ave	2,942

Table 5-3
MBTA Weekday Bus Ridership
(Continued)

Route #	Route Name	Weekday Boardings
80	Arlington Center-Lechmere via Medford Hillside	3,550
83	Rindge Ave.-Central Square, Cambridge via Porter	4,470
85	Spring Hill-Kendall via Union Square, Somerville	450
86	Sullivan -Union Square, Allston via Harvard	3,260
87	Arlington Center-Lechmere via Clarendon Hill	3,690
88	Clarendon Hill-Lechmere via Highland Avenue	5,390
89	Clarendon Hill-Sullivan via Broadway	5,200
90	Davis Square-Wellington via Sullivan & Assembly Square Mall	640
91	Sullivan-Central Square, Cambridge via Washington Street	2,400
92	Assembly Square Mall-Downtons via Sullivan & Haymarket	1,660
93	Sullivan-Downtown via Bunker Hill Street & Haymarket	4,350
94	Medford Sq.-Davis via West Medford & Medford Hillside	2,120
95	West Medford-Sullivan via Mystic Avenue	1,730
96	Medford Square-Harvard via Davis	2,910
97	Malden-Wellington via Commercial and Hancock Streets	690
99	Upper Highland Avenue-Wellington via Main Street	1,720
100	Elm Street-Wellington via Fellsway	1,270
101	Malden Station-Sullivan via Salem St, Main St, & Broadway	4,270
104	Malden Station-Sullivan via Ferry Street	2,960
105	Malden Station-Sullivan via Faulkner & Main Streets	890
106	Lebanon Street, Malden-Wellington via Main Street	2,200
108	Linden Square-Wellington via Malden Street & Highland Ave	2,490
109	Linden Square-Sullivan via Broadway	2,590
110	Wonderland or Broadway/Park Ave-Wellington via Park Ave.	2,080
111	Woodlawn-Haymarket via Mystic Bridge & Tobin Bridge	6,770
112	Wellington-Maverick via Central Ave & Mystic Mall	1,410
116	Wonderland-Maverick via Revere Street	4,040
117	Wonderland-Maverick via Beach Street	3,130
119	Northgate-Beachmont Sta. via Revere Center	1,160
120	Orient Hts. Sta.-Maverick via Bennington Street & Jefferies Pt	3,980
121	Wood Island-Maverick via Lexington Street	380
130	Lebanon Street, Melrose-Malden Station via Forestdale	780
131	Melrose Highland-Malden Station via Oak Grove	660
134	North Woburn-Wellington via Medford Square	2,460
136	Reading Sq-Malden Station via Oak Grove	970
137	Reading Sq-Malden Station via Oak Grove	1,149
210	Quincy Center-Fields Corner via North Quincy	1,120

Table 5-3
MBTA Weekday Bus Ridership
(Continued)

Route #	Route Name	Weekday Boardings
211	Quincy Center-Squantum via North Quincy	960
212	Quincy Center-North Quincy via Billings Road	430
214	Quincy Center-Germantown via Sea Street & Oceanview	1,450
215	Quincy Center-Ashmont via West Quincy & East Milton Square	1,730
216	Quincy Center-Houghs Neck via Sea Street	1,700
217	Wollaston Beach-Ashmont via Wollaston	650
220	Quincy Center-Hingham	1,890
221	Fort Point-Quincy Center	170
222	Quincy Center-East Weymouth	1,970
225	Quincy Center-Weymouth Landing via Des Moines Road	2,270
225A	Quincy Center-Weymouth Landing via Quincy Avenue	350
230	Quincy Center-Brockton Line via Braintree Station	1,600
236	Quincy Center-South Shore Plaza via Braintree Station	520
238	Quincy Center-Crawford Square, Randolph via Quincy Adams	1,450
240	Avon-Ashmont via Randolph	2,060
245	Quincy Center-Mattapan via Quincy Hospital & Pleasant Street	620
252	South Weymouth-Braintree Station	90
300	Riverside-Downtown Express via Mass Pike	1,610
301	Brighton Center-Downtown Express via Oak Sq & Mass Pike	2,220
302	Watertown Square-Copley Square Express via Mass Pike	1,330
304	Watertown Square-Downtown Express via Mass Pike	2,440
304A	Newton Corner-Downtown Express via Mass Pike	1,380
305	Waltham Center-Downtown Express via Moody St & Mass Pike	1,440
325	Elm Street, Medford-Haymarket Express via I-93	1,030
326	West Medford-Haymarket Express via I-93	970
350	Burlington/Billerica Line-Alewife via Arlington Center	840
352	Burlington-Boston via Route 128 & I-93	670
353	Burlington Industrial Area-Boston via I-93	400
354	Woburn Center-Haymarket or Park Square via I-93	628
400	Lynn-Haymarket via Lynn Common	1,950
411	Malden Station-Revere House via Granada Highlands	660
426	Lynn & East Saugus-Haymarket via Cliftondale	2,210
429	Central Square, Lynn-North Saugus via Myrtle	420
430	Appleton Street, Saugus-Malden Station	880
433	Pine Hill-Central Square, Lynn	270
435	Lynn-Danvers via NS Shopping Center & Liberty Tree Mall	780

Table 5-3
MBTA Weekday Bus Ridership
(Continued)

Route #	Route Name	Weekday Boardings
437	Lake Shore-Central Sq, Lynn via Eastern Avenue & Lakeside	500
436	Happy Valley-Central Square, Lynn	530
439	Central Square, Lynn-Nahant	210
440	Lynn-Haymarket via Lynnway & General Edwards Bridge	2,100
441	Marblehead-Downtown via Paradise Rd & Central Square, Lynn	920
442	Marblehead-Downtown via Humphrey St & Central Sq, Lynn	1,150
450	Salem-Haymarket via Highland & Western Avenue	1520
451	North Beverly-Salem	530
455	Salem-Haymarket via Central Square, Lynn	1,430
458 /468	Salem Center-Danvers via Liberty Tree Mall & Endicott Plaza	440

increased due to the restoration of service on the Needham Line and operation of service through the Southwest Corridor and the new Back Bay Station, both of which occurred in 1987.

For 1989, ridership continues to grow but at a slower rate. The slower rate represents a more natural rate of growth now that major improvements have had their initial impact. Also, parking shortages are now limiting access to commuter rail service.

Commuter Boat

Since its implementation in fiscal year 1984, commuter boat service has exhibited a dramatic increase in ridership. As shown in Table 5-6, annual ridership has more than tripled since fiscal year 1985 from 800 trips per weekday to 2,500 trips per weekday.

SERVICE AND RIDERSHIP PROJECTIONS

Since 1982, MBTA ridership has increased due to a number of factors. Until the 1989 fare increase, fares had remained stable, and therefore have decreased relative to other costs. The MBTA has expanded service and modernized the bus, rapid transit, and commuter rail fleets, thus improving the quality of service. The growth in jobs in downtown Boston, coupled with a large growth in the workforce in the MBTA district has resulted in increases in the

Table 5-4
Annual Commuter Rail Ridership

	1983	1984	1985	1986	1987	1988
North Side						
Rockport/Ipswich	2,332,658	2,042,534	1,883,709	1,968,249	2,452,830	2,489,237
Haverhill	1,423,503	1,149,597	1,206,308	1,056,476	1,532,005	1,719,733
Lowell	1,398,015	1,093,726	1,266,692	1,293,107	1,771,436	1,977,357
Fitchburg	1,341,879	1,135,290	1,283,566	1,074,069	1,564,180	1,753,545
Total North	6,496,055	5,421,147	5,640,275	5,391,901	7,320,451	7,939,872
Percent Increase		-16.5%	4.0%	-4.4%	35.8%	8.5%
South Side						
Framingham	897,896	1,107,723	1,141,736	1,237,916	1,344,172	1,538,269
Needham	0	0	0	0	245,637	1,286,923
Franklin	1,561,447	1,709,454	1,775,496	1,889,026	1,950,696	2,221,813
Fairmont	0	0	0	0	60,402	496,334
Attleboro/Stoughto	2,390,614	2,919,846	3,272,926	3,529,199	3,729,232	4,326,396
Total South	4,849,957	5,737,023	6,190,158	6,656,141	7,330,139	9,869,735
Percent Increase		18.3%	7.9%	7.5%	10.1%	34.6%
Total System	11,346,012	11,158,170	11,830,433	12,048,042	14,650,590	17,809,607
Percent Increase	#REF!	-1.7%	6.0%	1.8%	21.6%	21.6%

Source: MBTA Railroad Operations Directorate

Table 5-5
Weekday Commuter Rail Ridership

	1983	1984	1985	1986	1987	1988
North Side						
Rockport/Ipswich	8,044	7,043	6,496	6,787	8,458	8,584
Haverhill	4,909	3,964	4,160	3,643	5,283	5,930
Lowell	4,821	3,771	4,368	4,459	6,108	6,818
Fitchburg	4,627	3,915	4,426	3,704	5,394	6,047
Total North	22,400	18,694	19,449	18,593	25,243	27,379
Percent Increase		-16.5%	4.0%	-4.4%	35.8%	8.5%
South Side						
Framingham	3,096	3,820	3,937	4,269	4,635	5,304
Needham	0	0	0	0	4,466	4,438
Franklin	5,384	5,895	6,122	6,514	6,727	7,661
Fairmont	0	0	0	0	1,098	1,711
Attleboro/Stoughto	8,243	10,068	11,286	12,170	12,859	14,919
Total South	16,724	19,783	21,345	22,952	29,785	34,034
Percent Increase		18.3%	7.9%	7.5%	29.8%	14.3%
Total System	39,124	38,476	40,795	41,545	55,028	61,412
Percent Increase		-1.7%	6.0%	1.8%	32.5%	11.6%

Source: Annual Passengers (from Table 5-4)/290 except 1987 Needham and Fairmont Lines (Annual Passengers/55)

Figure 5-3
Average Weekday Commuter Rail Ridership by Station
(June 1989)

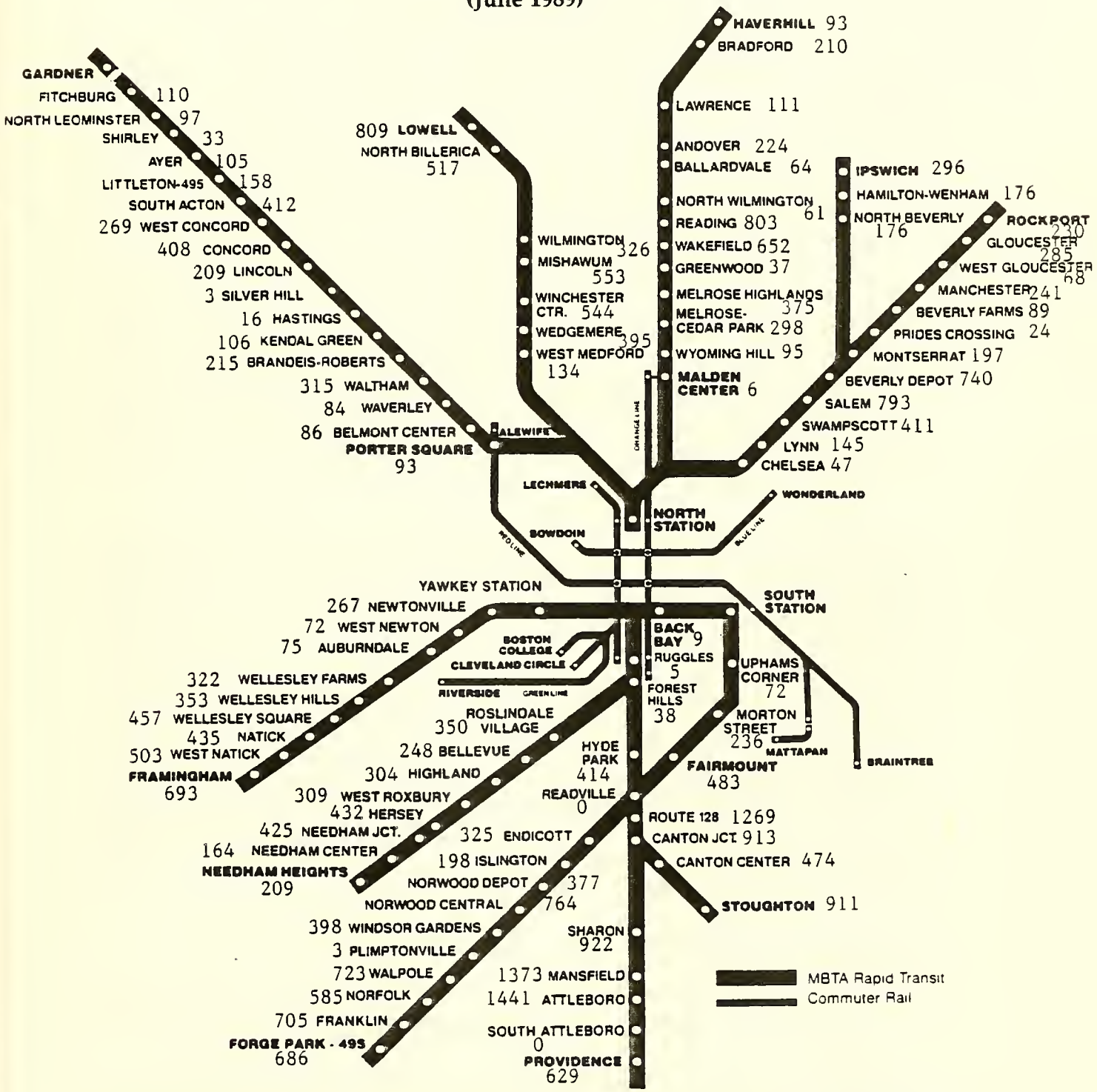


Table 5-6
Commuter Boat Passengers

	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89
Annual	31,099	194,245	272,507	383,861	527,595	627,325
Weekday	797	777	1,086	1,529	2,069	2,499

number of daily work trips, many of which are made on the MBTA. The combination of these factors has resulted in an increase in MBTA basic system ridership of nearly 25 percent since 1982.

At the present time, these ridership increases have resulted in systemwide parking shortages, and all MBTA rapid transit parking lots, with the exception of Alewife, and most commuter rail lots, are currently at or above capacity. Recent estimates project actual parking demand for rapid transit at up to 13,900 more spaces than the 16,858 spaces that now exist.[10] These parking shortages effectively constrain the capacity of the MBTA system and result in unmet transit demand: many potential riders that wish to use the MBTA do not because they cannot.

Over the next ten years, employment is expected to continue to increase, downtown Boston parking costs will continue to increase, traffic congestion will likely continue to get worse, and continued high housing costs should continue to result in longer commutes. Each of these factors should result in continued ridership growth on the MBTA. To meet future demand and existing unmet demand, to make service more convenient and comfortable, as well as to properly maintain the system, the MBTA will continue to expand capacity, introduce new service, and implement operational and maintenance improvements. Projects that have been approved for inclusion in the Transportation Improvement Program (TIP) are as shown in Table 5-7. The most significant of these are also described further in the following sections. Advancement of these projects is contingent upon funding availability. Limited capital funding will slow project implementation while increased funding will result in an accelerated schedule.

Rapid Transit and Light Rail Transit

Planned improvements to the rapid transit and light rail transit system include station/line relocation, station modernization, vehicle acquisition,

[10]CTPS draft Technical Memorandum, "Rapid Transit Patronage and Parking Estimates," William Massicott, Pamela Sears, Ronald Shimizu, August 21, 1989.

Table 5-7
MBTA Capital Program Summary
1990 - 1994

	Cost (in Millions)
Efficiency Projects	
Signal Improvements Communications	$33.00
Systemwide Improvements	80.00
Park Ride Improvement Program	84.30
Lechmere Maintenance Facility	35.00
Red Line Management Facility	5.20
Police Headquarters at JFK/UMass	26.20
Subtotal	$264.00
Renovation Projects	
Track Improvements	$79.00
Power/Electrification	75.00
Tunnel Rehabilitation/ Ventilation	34.00
MBTA Bridge Program	10.00
Station Modernization/ Platform Lengthening	257.00
Commuter Rail: Track	594.00
Commuter Rail: Signals	60.00
Commuter Rail: Park-Ride/Stations	129.40
Commuter Rail: Bridges	35.00
Commuter Rail: Maintenance Facilities	119.20
Commuter Rail: RTA's	31.30
Rapid Rail and Light Rail Maintenance/Facilities	100.00
20 CATA Capital Improvements	0.15
Subtotal	$1,564.05
Replacement Projects	
Vehicles: Rapid Rail	$210.00
Vehicles: Light Rail	165.00
Vehicles: Buses	121.50
Vehicles: Replacement Parts	8.00
Commuter Rail: Vehicles	30.00
Bus Maintenance Facility Replacement	0.50
Lechmere Station	50.00

Table 5-7 (Cont.)
MBTA Capital Program Summary
1990 - 1994

	Cost (in Millions)
Replacement Projects (Cont.)	
North Station Transportation Improvement Project	200.00
Washington Street Replacement	110.00
Subtotal	$895.00
New Service Projects	
South Station Transportation Center	$120.00
Bowdoin-Charles Connector	37.50
Circumferential Transit	6.00
Blue Line to Lynn	100.00
Old Colony Railroad Rehabilitation	384.50
Commuter Rail: Ipswich to Newburyport	27.00
Commuter Rail: Framingham Extension	25.00
Commuter Rail: Worcester Extension	54.00
Commuter Rail: New Bedford Extension	206.00
Commuter Rail: Foxboro Extension	8.00
West Cambridge Station	7.00
Hingham Commuter Boat Terminal	9.30
South Boston Piers Transit project	157.00
Subtotal	$1,141.30
TOTAL 1990-1994 CAPITAL PROGRAM	**$3,864.35**

increased service frequency, and parking expansion. No major extensions or new lines are scheduled for completion by 1995. However, the MBTA has performed planning studies for potential major expansion projects including: the South Boston Piers/Fort Point Channel Underground Transitway, the Bowdoin-Charles Connector, the Green Line extension beyond Lechmere, the Blue Line extension beyond Wonderland, and a Circumferential Transit Line. Other planned improvements include:

Parking Expansion - A total increase in rapid transit station parking supply ranging from 2,875 spaces to 11,000 spaces is expected. Current proposed station parking expansions include Braintree, Quincy Adams, Beachmont, Orient Heights, Waban, Sullivan Square, and Forest Hills.

Rolling Stock In 1990, the MBTA will order 86 new Red Line cars to replace the oldest existing cars, which are the least reliable in the system.

Also planned are subsequent purchases of 46 new Orange Line cars and 28 new Blue Line cars.

Green Line Relocation between North Station and Lechmere - The MBTA plans to relocate the Green Line between North Station into a subway, create a Green Line/Orange Line/commuter rail "superstation", expand Lechmere station, and build a maintenance facility at Lechmere. The new station at North Station will provide for improved connections with commuter rail, as well as cross-platform transfers between the Green and Orange Lines. Preliminary design on the new Lechmere Station and maintenance facility should be completed by mid-1990, and the new station at North Station is scheduled for completion in 1995.

Blue Line Station Modernization/Platform Lengthening and Signal Improvements - Blue Line stations are scheduled for modernization and platform lengthening by 1995. The platform lengthening will allow six car trains to be operated, which will increase capacity up to 50 percent. The MBTA is also now in the process of completing installation of a new signal system and other communications improvements, which will increase reliability.

Service Frequency - The above equipment purchases and capital projects, along with other improvements, will allow a reduction in peak period headways to 3 minutes on all trunk lines. Table 5-8 summarizes the planned changes in peak hour service frequency and capacity.

With these service improvements, total ridership on rapid transit and light rail services is projected to continue to increase at an annual rate of 3.5 percent per year, or approximately 18 to 19 percent between 1990 and 1995. Following completion of parking expansion, station modernizations, the Green Line relocation and capacity expansion, growth rates are expected to be slightly higher.

Bus and Trackless Trolley

Planned improvements to the MBTA bus and trackless trolley system include new bus terminal facilities at the new North and South Station Transportation Centers and the new Lynn transit station. The MBTA recently placed an additional 200 new buses into service, and expects to purchase an additional 500 between 1990 and 2000. There are also projects underway or planned to upgrade existing maintenance facilities and to construct new facilities.

Table 5-8
Change in Peak Hour Rapid Transit Capacity, 1988-1995[11]

	Headways (min)	Train Length (# cars)	Trains /Hour	Line Capacity (# pax)
Red Line				
1988	4	4/6	15	10,800
1995	3.5	6	20	21,600
Change	-13%	≈50%	+33%	+100%
Orange Line				
1988	4	4	15	9,300
1995	3.5	6	17	15,800
Change	-13%	50%	+13%	+70%
Blue Line				
1988	4	46	15	6,600
1995	3	6	20	13,200
Change	-25%	50%	+33%	+100%
Green Line Central Subway				
1988	1.7	1-3	35	7,280
1995	1.4	3	43	16,770
Change	-18%	+88%	+13%	+129%

The one major bus service expansion program planned is for Washington Street replacement service. The MBTA is currently proposing to construct a trackless trolley line between Dudley Square and downtown Boston to replace elevated Orange Line service that was relocated to the Southwest Corridor. As proposed, the project would include rehabilitation of the old Dudley Orange Line Station and direct connections to the subway system at Boylston Station.

Commuter Rail

Planned improvements to the commuter rail system include system expansion, station construction and upgrading, vehicle acquisition, increased service frequency, and parking expansion. These include:

[11]Sources: MBTA, South Boston Piers/Fort Point Channel Transit Alternatives, Draft Environmental Impact Report, December 1988; Final Environmental Impact Report, Fan Pier Development, November 1986; MBTA Draft Capital Construction Program, Future Improvements.

Park-n-Ride Expansion - A total increase of between 12,960 and 29,714 parking spaces are planned. The target for the next two fiscal years are for increases of 4,300 and 5,000 spaces, respectively.

Old Colony Line Restoration - This project would restore commuter rail service to the three branches (Greenbush, Middleborough, and Plymouth) of the Old Colony Railroad which served southeastern Massachusetts until 1959. The initial phase, scheduled to be completed in 1992, includes implementation of service to Braintree, where passengers could then reach downtown Boston via the Red Line. Service extension to South Station is scheduled for completion by 1995.

Commuter Rail Extensions - The MBTA is currently planning to extend the Ipswich Line to Newburyport in late 1992 pending approval of federal funding. Extension of commuter rail service to Milford, Worcester, Marlborough, Fall River, and New Bedford is also being examined.

Station Improvements - At North Station, a new commuter rail station will be built as part of a redesigned multi-modal transportation center. This will include the construction of two new tracks and accessible high platforms for persons with disabilities, and which are scheduled for completion by 1990. In the City of Lynn, a new station is under construction which will include new station platforms, an on-street bus terminal, a 1,032 space parking garage, and retail space. The Lynn station is scheduled for completion in late 1990. At South Station, a new track will be added and one level of a parking garage will be built as part of Phase II of the South Station development program. This work is scheduled for completion by 1992.

Vehicle Acquisition - The MBTA will purchase 126 new rail cars to accommodate growing demand. These additional rail cars will consist of 51 single level coaches, delivery of which will begin later this year, and 75 double-deck coaches, which will be delivered beginning in 1991. The delivery of between 15 and 25 new locomotives is also expected by late 1990 or early 1991.

The above equipment purchases, along with other improvements, will allow a reduction in peak period headways to 20 minutes on all lines by 1995. These service improvements, plus new ridership attracted by restored Old Colony service (22,000 trips per weekday) are projected to increase commuter rail ridership by nearly 65 percent by 1995 to between 95,000 and 100,000 trips per weekday.

Summary

To ensure that ridership continues to grow in the future as it has since 1982, the MBTA is planning to continue to upgrade all modes of service. Most rapid transit and bus service improvements that occur over the next five years will be those that upgrade existing services – such as parking expansion, Blue Line improvements, the relocation of the Green Line and the new North Station project – that are needed to respond to the recent growth that has occurred and will continue to occur in those areas. Most major expansion is likely to occur on the commuter rail system to serve continuing increases in the number of persons commuting longer distances into Boston. Overall, the MBTA believes that the 3.5 percent annual growth rate that has been occurring since 1982 on rapid transit and bus services can be maintained. On commuter rail, future increases are likely to be lower than in the past two years, since major improvements implemented during that time have had their major impacts, but that a 3.5 percent growth rate can be achieved in future years on commuter rail as well.

6. MBTA Fares and Parking Fees Before and After the Fare Increase

The 1989 fare increase raised fares for most rapid transit, express bus and commuter rail service, as well as for the D/Riverside branch of the surface Green Line. The fare increases were implemented in two phases: first commuter rail fares were increased on March 1, 1989, and then two months later on May 1, rapid transit, D/Riverside Green Line, and express bus fares were increased. In both cases, to encourage pass purchases, cash fares were increased one or two months before pass prices. The pass structure was also revised to provide additional incentives for riders to purchase passes. Bus fares were left unchanged to maintain a lower cost alternative for low income transit dependent riders, and to lessen the impact of the fare increase on riders that transfer between modes.

Parking fees at existing fee lots were increased at the end of October 1989, and beginning in December 1989, the MBTA began to charge a $1 per day parking fee at commuter rail lots. A chronology of the fare and parking fee changes is as follows:

- March 1, 1989: Commuter rail cash fares increased 17 to 33 percent.
- April 1, 1989: Commuter rail pass and multi-ride ticket prices increased approximately 25 percent.
- May 1, 1989: Rapid transit and express bus fares increased up to 32 percent.
- July 1, 1989: Rapid transit, D/Riverside Green Line, and express pass prices increased up to 30 percent, and new pass structure implemented.
- October 30, 1989: Parking Fees at most rapid transit parking lots, and Mattapan, Milton, and Arlington Heights, increased by $1 per day.
- December 4, 1989: $1 per day parking fee implemented at first five commuter rail parking lots (Canton Junction, Mishuam, North Billerica, Route 128, and Salem)[12].
- January 2-16, 1990: $1 per day parking fee implemented at the Canton Center, Dedham Corporate Center, Forge Park, Franklin, Framingham, Norfolk, and West Natick commuter rail stations.

[12]For location of commuter rail stations, refer to Figure 5-3.

- June 4, 1990 and later: $1 per day parking fees scheduled for implementation at remaining MBTA commuter rail lots.

BEFORE AND AFTER CASH FARES

On March 1, 1989, commuter rail cash fares were increased by an average of 24 percent. Fares for trips to and from downtown Boston were increased as shown in Table 6-1. Commuter rail interzone fares, which are not shown in the table, were increased by 25¢. Previously, interzone fares were 75¢ for the first zone travelled, and 25¢ for each additional zone travelled. They are now $1.00 for the first zone travelled and 25¢ for each additional zone travelled. (For example, a trip from Zone 9 to Zone 7, which previously cost $1.25 (base fare of 75¢ plus 25¢ for each of the two additional zones), now costs $1.50.) All discounted fares for children, students, the elderly, and persons with disabilities increased as well, continuing to be priced at 50 percent of the adult fare.

Table 6-1
Before and After Commuter Rail Fares

	Before	After	Percent Change
To/from Boston			
Zone 1A	60¢	75¢	25%
Zone 1B	75¢	$1.00	33%
Zone 1	$1.25	$1.65	32%
Zone 2	$1.50	$1.90	27%
Zone 3	$1.75	$2.25	29%
Zone 4	$2.00	$2.50	25%
Zone 5	$2.25	$2.75	22%
Zone 6	$2.50	$3.10	24%
Zone 7	$2.75	$3.35	22%
Zone 8	$3.00	$3.60	20%
Zone 9	$3.50	$4.25	21%
Zone 10	$4.00	$4.75	19%
Zone 11	$4.50	$5.25	17%

On May 1, 1989, rapid transit and express bus fares were increased (see Table 6-2). The increase raised most rapid transit fares by 25 percent. Exceptions were the Mattapan High Speed Line and the surface portions of the Green Line. On the Mattapan High Speed Line, and surface portions of the B/Boston College,

Table 6-2
Before and After Adult Cash Fares
(Fare at Boarding Stop or Station, Unless Otherwise Noted)

	Before	After	Change
RAPID TRANSIT			
All Stations on Blue, Green, Orange and Red Lines, excluding Quincy Center, Quincy Adams, Braintree, surface Green Line stops & Mattapan High Speed Line	60¢	75¢	25%
Quincy Center	$1.20	$1.50	25%
Quincy Adams & Braintree			
Entrance Fare	$1.20	$1.50	25%
Exit Fare	60¢	75¢	25%
Quincy Center, Quincy Adams, & Braintree Local[13]	60¢	75¢	25%
Mattapan High Speed Line			
Inbound[14]	50¢	50¢	0%
Outbound	free	free	0%
Surface Green Line			
B, C, & E Branches			
Inbound	75¢	75¢	0%
Outbound	free	free	0%
D Branch			
Inbound			
Fenway Park - Reservoir	75¢	90¢	20%
Chestnut Hill - Riverside	$1.50	$1.75	17%
Newton Local	$1.50	90¢[15]	-40%
Outbound	free	free	0%
BUS			
Local/Zoned: One Zone	$0.50	$0.50	0%
Two Zone	$0.75	$0.75	0%
Three Zones	$1.00	$1.00	0%
Four Zones	$1.25	$1.25	0%
Five Zones	$1.50	$1.50	0%
Express: Zone 1	$1.00	$1.25	25%
Zone 2	$1.25	$1.65	32%
Zone 3	$1.50	$1.90	27%

[13]With warrant. – $1.75 charged at boarding station; 75¢ rebate given at exit station.
[14]Except for trips to Ashmont, which are free.
[15]With coupon. – coupon is given when exiting inbound trips in Newton and is good for next trip.

C/Cleveland Circle, and Arborway/E lines, fares were left unchanged. On the D/Riverside branch of the Green Line, base fares were increased either 17 or 22 percent, but the fare for Newton local trips was reduced by 40 percent. Express bus fares increased from 25 to 32 percent.

Fare collection procedures were left unchanged throughout the system except on the surface portion of the D/Riverside line, where a warrant system was implemented in order to reduce the Newton local fare. Here, inbound riders pay the full fare of $1.75 inbound for the first trip, and then ask the operator for a warrant valid for an 85¢ discount on the next trip, which reduces the cost of subsequent round trips to 90¢ (since there is no fare charged on outbound surface trips).

Also, on all trips with a base fare of 75¢ or less, the fare for the elderly and persons with disabilities was held constant at 10¢. For higher priced trips, the discount provided remained at 50 percent. The discount provided other special groups (children and students) also remained at 50 percent.

When taking into account fare collection practices that charge different fares in different directions for some trips (surface Green Line, Quincy and Braintree), the fare increases result in the "effective" one-way fares for various services shown in Table 6-3. Most trips made on the rapid transit system are those for which a 75¢ one-way fare is applicable. Longer trips on the Red Line and the D branch of the Green Line have higher effective fares, although Red Line Zone 2 and 3 fares are higher than comparable Green Line fares. Surface Green Line trips, Mattapan High Speed Line trips, and Newton Local trips can be made at lower cost than the base fare of 75¢.

BEFORE AND AFTER PASS FARES

Commuter rail pass fares were increased on April 1, 1989; rapid transit and express bus fares were increased three months later on July 1, 1989. The new pass structure was also implemented on July 1, 1989.

The new Pass Program is generally more flexible and easier to use than the prior pass structure, and provides larger discounts for pass use. Nearly all passes cover the same service as before, and all passes have been renamed. Unlike the old system, the face value of certain passes, such as the C/COMBO and D/COMBO*PLUS*, can also be used as partial payment on higher priced transit services, with the rider paying the difference in cash. Changes to the pass program are described below and summarized in Tables 6-4 and 6-5.

The A Pass has been renamed the LOCAL BUS Pass. As with local bus fares, the cost has not been changed and remains $18. The LOCAL BUS pass can be

Table 6-3
Equivalent One-Way Cash Fares
(Round Trip Cost Divided by Two)

	Before	After	Percent Change
RAPID TRANSIT			
All trips excluding those to/from Quincy Center, Quincy Adams, Braintree, surface Green Line stops & Mattapan High Speed Line	60¢	75¢	25%
Quincy Center, Quincy Adams, & Braintree Local Trips[16]	60¢	75¢	25%
to/from Quincy Center	90¢	$1.13	25%
to/from Quincy Adams & Braintree	$1.20	$1.50	25%
Mattapan High Speed Line			
to/from Ashmont	25¢	25¢	0%
Other	free	free	0%
Surface Green Line			
B, C, & E Lines			
Surface	38¢	38¢	0%
Surface - Subway	68¢	75¢	10%
D Line			
Newton Local	75¢	50¢[17]	-40%
Fenway Park thru Reservoir – Subway	68¢	83¢	12%
Chestnut Hill thru Riverside – Subway	$1.05	$1.25	19%
BUS			
Local/Zoned: One Zone	$0.50	$0.50	0%
Two Zone	$0.75	$0.75	0%
Three Zones	$1.00	$1.00	0%
Four Zones	$1.25	$1.25	0%
Five Zones	$1.50	$1.50	0%
Express: Zone 1	$1.00	$1.25	25%
Zone 2	$1.25	$1.65	32%
Zone 3	$1.50	$1.90	27%

[16]With warrant. Full fare of $1.50 is charged at boarding station and 75¢ rebate is given at exit station.
[17]With coupon. Coupon is given when exiting inbound trips in Newton and is good for next trip.

Table 6-4
Before and After Rapid Transit and Bus Pass Fares

	Before		After			Break Even Point (No. Round Trips)	
	Pass	Cost	Pass	Cost	% Inc	Before	After
RAPID TRANSIT:							
All Stations , excluding Quincy Center, Quincy Adams, Braintree, surface Green Line stops & Mattapan High Speed Line	B	$22	Subway	$27	23%	18	18
Quincy Center	C	$36	Combo	$40	11%	20	18
Quincy Adams & Braintree	D	$40	Combo*Plus*	$48	20%	17	16
Mattapan High Speed Line	A	$18	Local Bus	$18	0%	36	36
Surface Green Line							
B, C, & E Branches							
Surface Trips	A	$18	Local Bus	$18	0%	24	24
Surface - Subway	B	$22	Subway	$27	23%	16	18
D Branch							
Fenway Park-Reservoir							
Surface Trips	A	$18	Local Bus	$18	0%	24	20
Surface - Subway	C	$36	Combo	$40	11%	27	24
Chestnut Hill-Riverside							
Surface Trips	A +50¢		Local Bus +75¢		25% [18]	18	18
Surface - Subway	C	$36	Combo	$40	11%	18	18
BUS							
Local/Zoned: One Zone	A	$18	Local Bus	$18	0%	18	18
Two Zones	A +25¢		Local Bus +25¢		0%	18	18
Three Zones	A +50¢		Local Bus +50¢		0%	18	18
Four Zones	A +75¢		Local Bus +75¢		0%	18	18
Five Zones	A + $1.00		Local Bus + $1.00		0%	18	18
Express Bus: Zone 1	C	$36	Combo	$40	11%	18	16
Zone 2	D	$40	Zone 1	$52	30%	16	16
Zone 3	E	$48	Zone 2	$61	27%	16	16

[18]Cost increase at break-even point.

Table 6-5
Before and After Commuter Rail Pass Fares

	Before		After			Break Even Point (No. Round Trips)	
	Pass	Cost	Pass	Cost	% Inc	Before	After
To/from Boston							
Zone 1A	B	$22	Subway	$27	23%	18	18
Zone 1B	B	$22	Subway	$27	23%	18	18
Zone 1	D	$40	Zone 1	$52	30%	16	16
Zone 2	E	$48	Zone 2	$61	27%	16	16
Zone 3	F	$56	Zone 3	$70	25%	16	16
Zone 4	G	$65	Zone 4	$80	23%	16	16
Zone 5	H	$74	Zone 5	$90	22%	16	16
Zone 6	J	$79	Zone 6	$96	22%	16	15
Zone 7	K	$84	Zone 7	$102	21%	15	15
Zone 8	L	$89	Zone 8	$108	21%	15	15
Zone 9	M	$94	Zone 9	$114	21%	13	13
Zone 10	N	$99	Zone 10	$120	21%	12	13
Zone 11	P	$104	Zone 11	$126	21%	12	12
Interzone Fares - No. of Zones Travelled:							
One	1	$24	1	$32	33%	16	16
Two	2	$30	2	$39	30%	15	16
Three	3	$36	3	$46	28%	14	15
Four	4	$42	4	$53	26%	14	15
Five	5	$48	5	$60	25%	14	15
Six	6	$54	6	$67	24%	14	15
Seven	7	$60	7	$74	23%	13	15
Eight	8	$66	8	$81	23%	13	15
Nine	9	$72	9	$88	22%	13	15
Ten	10	$78	10	$95	22%	13	15
Eleven	11	$84	11	$102	21%	13	15

used as partial payment for service on zoned buses as well as the surface Green Line. The break-even point for local bus riders, which is the number of monthly cash trips required to equal the cost of a monthly pass, remains at 18 round trips.

The old B Pass, which cost $22, has been replaced by the new SUBWAY Pass which is priced at $27 (a 19 percent increase). This pass covers all of the subway and rapid transit stations within Zone 1, and commuter rail zones 1A

and 1B. The break-even point for the SUBWAY pass is 18 round trips, the same as the old B Pass.

The old C Pass, which cost $36, has been renamed the COMBO Pass and is priced at $40. It is valid for local bus service, the first $1.25 of express and zoned bus service, and well as all rapid transit stations except Braintree and Quincy Adams. For Zone One express bus riders, this represents a cost increase of 11%. Comparatively, cash fares rose 25%. The difference between the cash and pass increases has increased monthly pass savings from $8 to $15 per month. Also, the break-even point has been reduced from 18 to 16 round trips per month.

The COMBO Pass also is valid for service on the Red Line as far as Quincy Center and on all of the Green Line's D branch (as was the old C Pass). For riders boarding at Quincy Center, cash fares rose 25 percent, and at Riverside they increased by 19 percent, compared to the pass price increase of 11 percent. Therefore, these riders have also received an increased incentive to purchase passes, although the discount is higher for Riverside riders (at 27 percent) than for Red Line riders from Quincy Center (19 percent). The break even points for these riders are now 16 and 18 round trips per month, respectively, similar to other passes.

Under the old pass system, the D Pass included all C Pass service plus the last two Stations on the Red-Line (Quincy Adams and Braintree) and service on Zone 2 express buses, at a cost of $40 a month. Under the new pass system, the D Pass has become two new programs: the COMBO*PLUS* Pass for $48 and the ZONE 1 Pass for $52. The COMBO*PLUS* Pass includes all COMBO Pass and Red Line service to Quincy Adams and Braintree, but unlike the old D Pass, does not include Zone 2 express bus service. The ZONE 1 Pass is now required for Zone 2 express bus service, and also includes Zone 1 commuter rail service (from which the pass gets its name). The effect of these changes has been as follows:

> For Quincy Adams and Braintree pass users who now use the COMBO*PLUS* pass, there has been a 20% increase in pass costs. Compared to the cash fare, the break-even point has been reduced from 17 round trips to 16. Also, the pass discount has been increased from 24 percent to 27 percent.
>
> Zone 2 Express Bus riders who now use the ZONE 1 pass experienced a 30% increase in pass costs, and the break-even point of 16 round-trips was maintained. Under the D Pass, these two options of rapid transit or express bus service yielded the respective savings of 24 and 27 percent. Pass savings increased slightly from 27 percent to 28 percent.

The old system's E Pass, which was priced at $48 and which covered all D Pass

services plus Zone 2 commuter rail service has become the new ZONE 2 Pass, priced at $61. This pass is now required for Zone 3 express bus trips. For these Zone 3 express bus riders, monthly cash and pass prices both rose 27%. The break-even point was maintained at 16 round trips.

Finally, the old F Pass has been renamed the ZONE 3 pass and remains valid for the same services as is was previously (all MBTA services plus up to Zone 3 on commuter rail). The cost was increased from $56 to $70, a 25 percent increase. The break-even point remained at 16 round trips. However, former F Pass riders that used that pass to transfer from buses to the Red Line at Quincy Adams and Braintree can now use the COMBO*PLUS* pass, which as previously mentioned, is priced at $48. For these riders, the pass price was reduced by 14 percent, and, in effect, the bus connection is now provided for free.

Commuter rail passes beyond Zone 3 (Zones 4 through 11) increased in a similar manner to the ZONE 1 through ZONE 3 passes, as shown in Table 6-5. Increases ranged from 21 percent to 33 percent, with the lower percentage increases implemented for longer trips and higher percentage increases for shorter trips. Break-even points for commuter rail trips remain in the range of 12 to 18 round trips, although for most passes, it is 15 or 16 round trips.

Lastly, 12-Ride tickets are sold for commuter rail service, and 10-Ride tickets are sold for express bus and Riverside Green Line service. As before the fare increase, commuter rail 12-Ride tickets continue to be priced at the cost of 11 one-way trips. On the Green Line and express buses, with different fares now being charged on the outer end of the Green Line and on Riverside express buses, the old 10-Ride ticket that cost $14.00 for ten $1.50 rides has now been split into two new tickets: an $18 ticket valid for ten $1.90 express bus trips and a $16.50 ticket valid for ten $1.75 Green Line trips.

BEFORE AND AFTER PARKING FEES

Rapid Transit, Surface Green Line, and Bus Lots

Parking fees at parking lots on rapid transit, the surface Green Line, and at Arlington Heights were increased by $1 per day on October 30, 1989. Parking fees are now between $2.00 or $2.50 at all stations with the exception of Alewife, which has a daily charge of $4.00 (see Table 6-6). By line, daily fees at all lots on the Orange Line are now $2.50, all lots on the Blue line are $2.00, lots on the Green Line are $2.00, $2.25 or $2.50, and lots on the Red Line are $2.00, $2.50, or $4.00.

Table 6-6
Before and After Rapid Transit, Surface Green Line and Bus Lot Parking Fees

	Before	After
Green Line		
Riverside	$1.25	$2.25
Woodland	$1.00	$2.00
Waban	$1.00	$2.00
Eliot	$1.00	$2.00
Chestnut Hill	$1.00	$2.00
Lechmere	$1.50	$2.50
Average[19]	*$1.21*	*$2.21*
Orange Line		
Oak Grove	$1.50	$2.50
Malden Center	$1.50	$2.50
Wellington	$1.50	$2.50
Sullivan	$1.50	$2.50
Average	*$1.50*	*$2.50*
Red Line		
Alewife	$3.00	$4.00
North Quincy	$1.00	$2.00
Wollaston	$1.00	$2.00
Quincy Center	$1.50	$2.50
Quincy Adams	$1.50	$2.50
Braintree	$1.50	$2.50
Average	*$1.80*	*$2.80*
Blue Line		
Wonderland	$1.00	$2.00
Beachmont	$1.00	$2.00
Suffolk Downs	$1.00	$2.00
Orient Heights	$1.00	$2.00
Average	*$1.00*	*$2.00*
Other		
Mattapan	$1.00	$2.00
Milton	$1.00	$2.00
Arlington Heights	$1.00	$2.00
Average	*$1.00*	*$2.00*

[19]Weighted average based upon number of spaces on line.

Commuter Rail

Commuter rail parking fees are being implemented by groups of stations starting in December. Parking fees at all stations will be $1 per day. Stations at which parking fees have already been implemented are as shown below. Fees at remaining lots are scheduled to be implemented on or after June 4, 1990.

- December 4, 1989: Canton Junction, Mishuwam, North Billerica, Route 128, and Salem.
- January 2, 1990: Franklin, Framingham, Norfolk and West Natick.
- January 8, 1990: Canton Center
- January 16, 1990: Dedham Corporate Center and Forge Park

Parking fees are now collected as commuter rail patrons leave the station. This exit- payment system is used to ensure that the payment of parking fees does not result in patrons missing trains. However, because attendants are only on duty between 1:00 pm and 9:00 pm, revenue is not being collected from all riders. This "pay as you leave" system also results in delays in exiting stations during the PM peak due to the large number of patrons disembarking from single commuter trains. To improve this situation, and to increase the amount of revenue collected, an alternative system using payment boxes is now being considered. The payment box system would require patrons to deposit the parking fee in a slot in a box corresponding to their parking space number (as is now done at smaller stations on the surface Green Line). This would reduce delays and the number of personnel required, but could necessitate a number of physical changes to the lots.

1982 - 1989 FARES AND TRANSPORTATION COSTS

Because MBTA fares had not changed since 1982, and had not been increased since 1981, they have declined relative to other costs. The same is true of parking fees. Between 1983 and 1989, the consumer price index for intra-city public mass transit for the Northeast Region of the country has increased 27%, and average transit fares nationwide have increased over 55% between 1983 and 1987 from 40¢ to 62¢ (see Tables 6-7 and 6-8). During the same period, Boston's inflation rate has risen 30 percent. The MBTA's average fare, meanwhile has increased from 44¢ to only 45¢.[20] In constant dollars, average fares have decreased 18% from 44¢ to 36¢. By comparison, the cost of car ownership has gone up by 15% after adjusting for inflation, and despite a 22.5% decrease in the gasoline price index. Also, public parking rates in Boston have increased at three to four times the rate of local inflation.

[20]The increase in average fare is due to changes in the types of fares paid (i.e., more full fare passengers and fewer discounted fare riders), not changes in fare levels.

Table 6-7
Price Index Increases
1981 - 1989

	Boston Consumer Prices		Northeast Region Mass Transit Costs		Boston Private Transportation Costs	
Year	Price Index	% Inc	Price Index[21]	% Inc	Price Index[22]	% Incr
1983	290.0	4.4%	318.5	4.1%	326.5	1.0%
1984	304.2	4.9%	342.8	7.6%	338.6	3.7%
1985	318.0	4.5%	347.0	1.2%	347.8	2.7%
1986	326.2	2.6%	370.9	6.9%	333.6	-4.1%
1987	340.4	4.4%	386.1	4.1%	340.9	2.2%
1988	360.8	6.0%	395.3	2.4%	358.7	5.2%
1989	377.0[23]	4.5%	405.6	2.6%		

Table 6-8
MBTA Average Fares versus Nationwide Average Fares

	MBTA Average Fares	Percent Change	Average Fares Nation-wide	Percent Change	% Difference MBTA vs. National Average
CY1983	44¢		40¢		+10%
FY 1984	43¢	-2.8%	50¢	25.0%	-14%
FY 1985	44¢	3.9%	53¢	6.0%	-17%
FY 1986	44¢	0.1%	57¢	7.5%	-23%
FY 1987	45¢	0.8%	62¢	8.8%	-27%
FY 1988	45¢	1.2%			

As a result of these changes, MBTA fares have become much less expensive, both in comparison to total living expenses, and other transportation alternatives. With a 24 percent average fare increase, the MBTA's average fare will be 11 percent below the national average, and adjusted for inflation, lower than it was in 1982.

[21] January averages.
[22] Annual averages.
[23] Estimated

For MBTA riders that drive to MBTA parking lots, the combined impact of the increase in fares and parking fees has been 31 to 59 percent increase in MBTA charges (see Table 6-8). For some of these riders, MBTA prices have increased to a slightly higher degree than inflation, but for the most part, combined fare/parking fee increase have approximated increases in inflation. Further, the largest percentage cost increases were at the lower cost stations (all Blue Line stations with parking, and North Quincy and Wollaston), and the lowest percentage cost increases were at higher cost stations (Alewife, Quincy Adams and Braintree).

Table 6-8
MBTA Before and After Total Park and Ride Costs

	Before	After	Increase	% Increase
All Orange Line Stations w/Parking	$2.70	$4.00	$1.30	48%
All Blue Line Stations w/Parking	$2.20	$3.50	$1.30	59%
Green Line				
Riverside	$3.35	$4.75	$1.40	42%
Woodland, Waban, Eliot, Chestnut Hill	$3.10	$4.50	$1.40	45%
Lechmere	$2.70	$4.00	$1.30	48%
Red Line				
Alewife	$4.20	$5.50	$1.30	31%
North Quincy & Wollaston	$2.20	$3.50	$1.30	59%
Quincy Center	$3.30	$4.75	$1.45	44%
Quincy Adams and Braintree	$3.90	$5.50	$1.60	41%

Note: Costs include the daily parking fee plus the cost of two one-way trips. Costs at surface Green Line stations are costs for trips to and from the subway.

For rapid transit users that park at MBTA lots, the parking fee increase was more costly than the fare increase. For most rapid transit riders, the fare increase increased costs by 30¢ per round trip, or by $5 - $7 per month, (depending on the number of commuting days and whether or not passes were purchased). At Quincy Center the increase was 45¢ per round trip, or $4-$10 per month, and at Quincy Adams and Braintree, the increase was 60¢ per day or $8 - $13 per month. At the same time, the parking fee increase of $1 per day increased costs by $20 - $22 per month.

7. MBTA Service Monitoring and Ridership Estimation Procedures

MBTA RIDERSHIP AND SERVICE DATA COLLECTION

As described in Chapter 4, the MBTA performs most service planning on the basis of corridor bus studies or other project-specific studies. In each of these studies, ridership and service data is collected at the level of detail needed for the project (as was the case for this report). However, all service is also monitored on an ongoing basis to provide a means of tracking ridership on all modes. This data is used to identify systemic problems, to provide the data base needed to evaluate service proposals, and for other planning purposes.

The manner in which the data are collected and the level of detail and accuracy of estimates depends upon the purpose for which they are intended. In addition, many of the estimates include inherent limitations due to equipment constraints and other factors. The major sources of ridership and service data currently used by the MBTA are as follows:

- Revenue-based Ridership Estimates
  - –Rapid Transit based on RTL 210 Reports
  - –Surface Transit based on Section 15 Procedures
  - –Fare-Mix
- Commuter Rail Conductor Counts and Quarterly Audits
- CTPS Rapid Transit and Commuter Rail Counts
- Annual MBTA Boarding Counts at Rapid Transit Stations
- Traffic Checker Counts
  - –Bus Ridechecks
  - –Bus Pointchecks
  - –Specialized Counts

Revenue-based Ridership Estimates

Revenue-based procedures, which estimate ridership based on the amount of fare revenue collected, are used to estimate total ridership by mode. These estimates are used to provide information on ridership trends, the effectiveness of overall system improvements, and to meet federal reporting requirements. In general, revenue-based procedures provide a more cost effective method to estimate total ridership than actually counting all riders.

As described below, a number of revenue-based ridership estimates are developed on a regular basis.

Rapid Transit

MBTA daily rapid transit ridership figures are based largely on the MBTA Revenue Department's RTL 210 Report, which is designed to show the number of passengers entering each station each day. Estimates are made based on the recorded number of passengers paying each type of fare: tokens, cash, and pre-paid passes. Due to a number of factors, described below, the RTL 210 Report does not provide an exact accounting of ridership.

Token Readings Daily ridership figures for passengers entering stations through turnstiles and paying by token are based on the number of tokens collected daily.

Pass Readings Most pass users enter stations via turnstiles that are equipped with card readers. Such entries are registered on both the counter that registers tokens, and on a separate counter for passes only. At present, passes account for about one third of all MBTA fare revenue, so that malfunctioning counters can have a significant impact on ridership figures. To improve reliability of these readings, the MBTA has recently replaced all mechanical turnstile registers with electronic registers.

Timing of Revenue Collection Turnstile readings and revenue collection was previously conducted at different times of the day. Therefore, token figures, which were based on the number of tokens collected, and pass figures, which were based on register readings, did not always apply to the same time span. This practice has been changed and Revenue Department personnel now take register reading when revenue is collected. Revenue is now also scheduled for collection at the same time each day. However, because of traffic problems or other factors, Revenue Department collection trucks are sometimes delayed, so that daily figures may sometimes include more or less than one 24 hour period. Over a long period of time, however, these differences do not significantly effect ridership estimates.

Cash Fares Cash fares are supposed to be deposited either in Collector's booth turnstiles, or in Gatemen's boxes. Collector's booth cash boxes are supposed to be used only for payment of reduced fares by children, pupils, the elderly, or persons with disabilities. However, in practice, they are often used also by full-fare passengers who have exact change and don't want to stop to buy tokens, or by passholders when passreaders are broken. Gatemen's boxes are fareboxes next to a gate

that is open during peak periods and/or special events that are monitored by an attendant.

Collector's booth turnstiles are not linked mechanically with the cash boxes and are supposed to be unlocked by the collector in the booth, after observing that the appropriate fare has been deposited. However, the turnstiles are frequently left unlocked during busy periods in order to accommodate high volumes of passengers, so that it is possible to pass through without paying a fare. (Mechanisms are now being installed to prevent collector's booth turnstiles from being left unlocked.)

The Gatemen's boxes have no mechanical entry barriers, and hence no means of recording passenger entries automatically. Entry is instead controlled by an attendant standing by the open gate. The attendant checks that fares are paid but does not count passengers. As a result, no counts are recorded of those passing through the Gatemen's boxes. This ridership is estimated using an average fare computed for each station on the basis of periodic sample counts of passengers entering through these gates.

Annual Bus and Trackless Trolley Ridership and Passenger-Mile Estimates

Ridership on MBTA bus and trackless trolley lines is also calculated on the basis of revenue data. Selected bus routes from each garage are sampled to determine the fare mix of full cash fares, reduced cash fares, and passes, which, in turn, is used to calculate the overall average fare. This is done each year as part of the annual Section 15 report to UMTA, in which the MBTA is required to report estimates of passenger trips.

For each MBTA schedule quarter, CTPS generates a list of randomly-selected sample bus trips to be surveyed by MBTA personnel during the quarter. MBTA personnel record boardings and alightings on each sample bus trip; farebox revenue data is also recorded. After the completion of each quarter's survey sample, the MBTA transmits the completed bus-trip survey forms to CTPS for data-entry and processing. The data is processed and estimates of bus and trackless trolley passengers and passenger-miles are developed.

The sampling procedure used is intended to provide estimates of total system-wide bus ridership. Therefore, the resulting ridership figures are not representative of individual routes.

Fare-Mix Surveys

Fare-Mix Surveys are similar to Section 15 bus ridership surveys in that a sample of each type of ridership is used to estimate total ridership. As a result, these figures provide fairly accurate estimates of total ridership by mode, but are not accurate on a route-by-route or trip-by trip basis. These estimates are based on a random sample of ridership on each type of MBTA service, from which estimates of average passenger fare and the proportion of passengers using each fare category are developed. Then using this information combined with total revenue, estimates are made of ridership by mode and fare type. Fare-Mix surveys were first performed in 1981, and subsequently in 1982, 1983, 1984, and 1985, and now in the Spring and Fall of 1989 as part of the analysis of ridership changes resulting from the 1989 fare increase. Sampling for the before-fare increase estimates was completed on April 30, before implementation of the May 1, 1989 fare adjustments, and sampling for the "after" estimates took place in September, October and November of 1989.

(This process is discussed in more detail in the "Method for Estimation of Ridership Change of the 1989 Fare Increase" section, below.)

Commuter Rail Headcounts and Audits

The MBTA Railroad Operations Department receives daily headcount reports for each commuter rail trip from Amtrak, the contract operator of the service. These reports include estimates of all passengers on board each train at any time during the trip. Train conductors are responsible for preparing these reports. These reports are used to track ridership trends by line and to determine train consists.

All commuter rail fares are collected on board trains, and passengers do not pass through any turnstiles where they could be counted automatically as on rapid transit. Tickets are collected from passengers who use single or multiple-ride tickets; passengers using monthly passes are required to show them, but no physical evidence of pass use is turned in. When conductors are diligent about recording the number of passes shown, passenger counts are quite accurate. However, because of the large number of fares to be collected and the short distances between some stations, this method is not always possible and total train load estimates at the end of the trip are often based on the number of standees or empty seats.

More detailed passenger reports, known as ticket audits, are prepared four times a year. These reports show passenger boardings by station for all inbound trains for one weekday, and for one Saturday and one Sunday, where applicable. These figures are further subdivided by ticket type. Prior to the introduction of zone fares and monthly passes, ticket audits were actual

counts of tickets collected from each origin to each destination. At present, audit reports are simply a more detailed version of conductors headcounts. The difference between the total reported headcount and the number of tickets physically collected on each train is attributed to monthly passes.

Further, when there is insufficient time to complete the recording of fares from one station before the train arrives at the next one and both stations are in the same zone, tickets do not show definitely which station was used. In such cases, personnel responsible for preparing the audit reports attempt to estimate the correct breakdown.

At one time, audit reports showed both boarding and alighting stations. At present, only boarding points are included. Because of this, and the absence of any audits for outbound trains, there is no simple way to deduct local trips from totals to determine ridership into downtown Boston from the ticket counts. Counts taken by CTPS in the Winter and Spring of 1989 show significant transfer activity between commuter rail and rapid transit at some outlying connection points. The split between transfer trips and direct downtown Boston trips seems to vary more from day-to-day than does total ridership, as weather conditions or other factors make one option relatively more attractive on a particular day.

Counts for South Side commuter rail lines are further complicated by the fact that most trains stop at two "Downtown" stations, South Station and Back Bay, which are only 1.3 miles apart. Ticket audits do not include any breakdown of the relative use of these two stations. CTPS counts taken in the spring of 1989 indicate that a significant number of riders have destinations for which either station is about equally convenient. Many of these riders use Back Bay inbound, but South Station outbound, presumably to improve their chances of getting seats. Hence, changes in counts taken at either station alone may not be true reflections of actual changes in train loadings.

1985 Green Line Passenger Counts

In 1985, in conjunction with a study of capacity of the Central Subway system, special passenger counts were conducted, under the direction of CTPS, at all Green Line Central Subway stations and surface stops. These were the most comprehensive counts taken on the Green line since the 1978 system-wide passenger counts, and are the most detailed source of Green Line ridership information currently available.

The surface stop counts were done mostly during the Spring of 1985. They included direct counts of the numbers of passengers boarding and alighting at each stop, for each train that entered or left the Central Subway between 7:00 a.m. and 10:30 p.m. on a weekday.

The Central Subway counts were done during the Fall of 1985. They consisted of direct observations of the number of passengers entering or leaving each Central Subway station, by 15-minute intervals. The time span covered at each station was, at minimum, 7:00 am to 8:30 pm, although earlier starting times or later ending times were used at several stations. A sufficient number of observation points was established at each station to determine both boardings and alightings for each train direction. In contrast, most counts taken for the MBTA at pre-payment stations show entries only, with no breakdown by direction of travel.

At stations having more than one entry or exit, separate counts were made of the number of passengers passing through each point of transition between a paid and an unpaid station area. At three stations, Kenmore, Arlington, and Park Street, where there is a significant volume of reverse-direction transfers between different Green Line routes, direct observations were made of these transfers.

Four Central Subway Stations, Park Street, Government Center, Haymarket, and North Station, serve rapid transit lines in addition to the Green Line. At such stations, sufficient observation points were established to separate transfers to and from the Green Line, by initial and final route and direction, from outside entries and exits. Complete boardings and alightings were determined for both the Green Line and the connecting lines at these stations.

At North Station, the Green Line connects with all North Side commuter rail lines. The 1985 counts included direct observations of inbound alightings and outbound boardings for all commuter rail trains at North station between 6:30 a.m. and 9:00 p.m. on one weekday. To the extent possible, counts were made of the number of alighting passengers transferring to the Orange or Green Lines at North Station. Observations of outbound transfers were not possible due to the much greater dispersion of passenger arrivals in that direction.

Although the 1985 counts did not include any direct surveying of passengers for origin-destination information, the direct count results have been used as input to estimate origin-destination pairs on the basis of individual station boardings and alightings and distances between stations.

Special Rapid Transit and Commuter Rail Counts

During the early spring of 1989, special passenger counts were conducted for the MBTA by CTPS at all rapid transit stations not covered in the 1985 Green Line counts. These counts were performed to provide the MBTA with more comprehensive information on rapid transit ridership than was available from other sources for use in planning rapid transit system improvements. Partial counts were also done at some Green Line stations for comparison

with 1985 results. Boarding and alighting counts were also done for commuter rail trains at North Station, South Station and Back Bay, and at four outlying stations where direct transfers between commuter rail and rapid transit lines are possible. At South Station and Back Bay, boarding and alighting counts were also done for Amtrak intercity trains.

At all stations covered in the counts, the observation time span was scheduled to include, at minimum, all trains that would pass through the center of the system in Downtown Boston between 7:00 a.m. and 9:00 p.m. Preliminary results indicated that certain stations had heavy ridership on trains arriving downtown even earlier than this. To the extent possible in the time available, supplementary early counts were done at these stations. The information collected in these counts included both boardings and alightings on a train-by-train basis.

The 1989 counts included all stations on the Orange, Blue and Red lines, and on the Mattapan High Speed Trolley line except that complete counts were not done at stations where any of these lines connect with the Green Line Central Subway. At these stations, spot-checks of ridership were done for at least four hours to update 1985 Green Line volumes. In addition, detailed transfer data was collected at each transfer station:

At Downtown Crossing, where the Red and Orange lines connect, and at State, where the Orange and Blue lines connect, sufficient observations were made to determine transfers by initial and final train route and direction as well as outside entries and exits. At Red Line stations south of Downtown Crossing (South Station, Broadway, Andrew, and JFK/UMass) served by both Ashmont and Braintree trains, sufficient information was collected to determine ridership separately for each route.

At North Station, where the Orange Line connects with the Green Line and with commuter rail, both Orange Line total boardings and alightings, and transfers to and from the Green Line were counted. Green Line external entries, but not exits, were also counted. Transfers from commuter rail to the Orange and Green lines were observed in the morning peak only.

At Haymarket, where the Orange and Green lines connect, transfers between the two lines, by train direction, were counted, but external entries and exits were not counted for either line.

At Government Center, where the Blue and Green lines connect, total Blue Line boardings and alightings were counted. These were not fully separated by train direction, but the 1985 counts show that most Blue Line ridership at this station is eastbound boardings and westbound alightings. Sufficient additional information was collected to determine the number

of transfers between the Green and Blue lines, but outside entries and exits for the Green Line were not counted.

At Park, where the Red and Green lines connect, sufficient information was collected to compute some of the transfer moves, but outside entries and exits were not counted for either line.

At Back Bay, Ruggles, Forest Hills, Porter Square, and Malden, passengers transfer between commuter rail and rapid transit lines. To the extent possible, direct observations of such transfers were made by initial and final route and direction, for each commuter rail trip during the counting span.

At South Station a fully-indoor transfer system between commuter rail and the Red Line is under construction. This project, as well as an overall modernization and remodelling of both stations, severely disrupted the normal pedestrian flows between the Red Line and commuter rail throughout the span of the 1989 passenger counts. As a result, no direct observations of transfers were possible there.

Annual MBTA Boarding Counts at Rapid Transit Stations

Beginning in 1988, the MBTA has conducted a one day count of rapid transit boardings during the second week of April. These counts are based on all day turnstile readings, counts of passengers passing through the fare gates, and revenue-based estimates of passengers passing through the collectors gate. These counts are intended to provide a "snapshot" of typical ridership activity during the same week every year. These counts are subject to many of the same limitations as the RTL 210 reports due to equipment constraints.

Traffic Checker Counts

Traffic checkers perform three types of counts: peak-load point counts, ridechecks and specialized route segment counts. All counts provide the MBTA Service Planning and Schedules Departments with route specific data on ridership by time of day. However, the level of detail varies among the types of counts. A description of each type of count follows:

- Ridechecks (Characteristic Counts) provide boarding and alighting information for each stop along the trip, as well as running time and schedule adherence information. They are performed on request from various departments in the Authority for special studies and as a part of the MBTA's bus corridor studies. To conduct ridechecks, a traffic checker rides the bus and records the date, weather, the scheduled departure time, the actual departure time, passenger boardings and alightings, and the time at specific points along the route and at the end

of the route. Ridechecks of most bus routes have been performed as part of the corridor bus studies, and are now also being conducted more frequently for all routes.

- Pointchecks (Peak-load Point Counts) provide peak loading data used for level of service analyses. To perform pointchecks, a checker stands at the peak load point of a route and records the date, weather, location of count, and then the time, vehicle number, and number of passengers on board for every bus passing that point. They are performed at the peak load point of each route once per quarter and more often when additional information is needed for specific analyses. They are usually performed from the beginning of the AM peak until at least the end of the PM peak. Pointchecks are then summarized by time period, and by intervals within the time period. Total ridership at each peak load point per time period is divided by number of vehicles per time period to determine average loading. These counts also are often used to update ridecheck counts.

- **Specialized counts** are designed to provide data for specific purposes and are summarized as needed by the department requesting the information.

Ridecheck, pointcheck and specialized count data are used mainly by the Schedules and Service Planning Departments. The Schedules Department uses the data to make minor changes in the schedules. Service Planning uses the information to evaluate route change proposals, service changes, and new routes. Information derived manually from traffic checker counts include passengers/mile, passengers/hour, average fare, passengers/trip, and ridership by route segment.

Although ridecheck counts are more detailed than pointcheck counts, pointchecks have traditionally been used to collect quarterly route data because they are significantly less labor intensive. However, because of the method in which they are collected (with the checker outside of the bus estimating loads inside of the bus), it is difficult to achieve a high level of accuracy. Also, when updating older ridecheck information based on pointcheck data, an assumption is made that the peak load point has remained at the same location. While this is usually the case, peak load points can shift, especially on routes in areas where other service changes have taken place. As a result of these limitations, the MBTA plans to begin conducting more ridechecks and fewer pointchecks.

The collected information is maintained and processed through the use of two database programs: VAX TIM, which runs on the MBTA's VAX computer and inTransit, which is a Macintosh-based program developed for use with MBTA ridership and survey data. Both applications, between which

data can be shared, include a description of all MBTA bus routes by segment and stop, including the mileages between stops. Collected ridership and running data can then be linked to route description data to provide descriptive reports detailing ridership trends, profiles, and schedule data.

METHOD FOR ESTIMATION OF RIDERSHIP CHANGE OF THE 1989 FARE INCREASE

The major mechanisms used to estimate "before" and "after" ridership were the Fare-Mix Surveys and Commuter Rail counts described above in the "MBTA Ridership Data Collection" section, with adjustments applied using the other data sources. This resulted in before and after estimates of total rapid transit, surface Green Line, bus, and commuter rail ridership. Estimates of more specific sub-regional impacts were made using CTPS' Regional Transit Model .

Because of the expense and time that would have been required to make actual counts of the over one million unlinked weekday trips made on the MBTA rapid transit, surface Green Line and bus ridership estimates were based largely on a sampling process. However, a large amount of actual count data does exist – 1989 rapid transit counts, updated 1985 Green Line count data, and express bus pointchecks – as well as estimates from other sampling procedures. These were used to make corrective adjustments to the estimation process and to verify the results.

Rapid Transit, Surface Green Line and Bus

Preliminary Rapid Transit, surface Green Line and bus ridership estimates were made based on the "before" and "after" Fare-Mix Surveys. These provide estimates of total ridership broken down into three groups – rapid transit excluding the surface Green Line, the surface Green Line, and bus (local, express, and trolley bus).

In summary, this involved the following:[24]

"Before" Estimates

As described previously, Fare-Mix Surveys provide an estimate of total ridership based on the amount of revenue collected on each mode. Using a random sample of ridership on each type of MBTA service, estimates of average passenger fare and the proportion of passengers using each fare

[24]This process will subsequently be described in detail for both the before and after counts in a separate report, which is currently scheduled for completion in the Summer of 1990.

category were developed. This information, combined with total revenue, provides the necessary information to estimate ridership by mode and fare type. Sampling for the before-fare increase estimates was completed on April 30, before the May 1, 1989 fare adjustments.

Data collection for both the before and after fare-mix surveys were performed in the same manner. To develop average fare and fare category estimates, the number of passengers by fare category (adult cash, adult pass, elderly and handicapped, student pass, student half-fare, authorized free, and unauthorized free) and farebox revenue are recorded for a sample of MBTA passengers on each mode (bus and trackless trolley, surface Green Line, and rapid transit).

Fare-mix estimates for surface trips were generated by surveying the type of fare paid by all passengers on board the vehicle for bus, trackless trolley, and surface Green Line vehicle trips, and at station entrances for rapid transit. Farebox revenue data was also recorded on all sampled vehicles, and at all turnstiles, collector's fareboxes, and gateman's fareboxes at sampled stations.

For both bus (including trackless trolley) and Green Line surveying, an UMTA-recommended revenue-based sampling procedure was used. For bus service, CTPS provided the MBTA with a randomly-generated list of bus trips to be sampled. On the surface Green Line, this method would be inefficient due to the imprecise timing of Green Line trips as they exit the Central Subway. Instead, surface Green Line surveying was performed using a procedure that generated a random selection of Green Line trips without provision of a pre-selected trip sample list. Rapid transit trips were sampled by station, rather than by trip, since fares are paid when passengers enter the station.

Once data had been collected, it was processed to develop estimates of average fare and fare category proportions by mode. Then, using total revenue data by mode, and dividing by the average fare by mode, estimates were made of total rapid transit, surface Green Line, and bus ridership. This resulted in estimates of total rapid transit, surface Green Line, and combined local and express bus ridership.

"After" Estimates

The "after" survey was performed in October and the beginning of November of 1989. These months were used for "after" sampling because the characteristics of Spring and Fall travel, as well as overall ridership levels, are similar. Summer vacations had ended and schools were in session. In addition, this should have allowed sufficient time between the

fare increases and the "after" sampling to eliminate inclusion of any immediate but not long lasting impacts.

The "before" and "after" Fare-Mix studies were performed in the same manner (as described above) in order to ensure consistency between the two surveys.

While the use of these sampling procedures generated estimates of total ridership changes for rapid transit, the surface Green Line, and local bus ridership, they did not provide impact estimates in specific areas or on specific routes. Therefore, where these types of estimates were needed for environmental and socioeconomic analyses, they were generated using CTPS' Regional Transit Model, which simulates ridership changes on a zone basis using total change values.

Commuter Rail

The impact of the 1989 fare increase on commuter rail ridership was estimated using conductor count data provided by the MBTA Railroad Operations Department and counts conducted by CTPS. Actual counts of passenger boardings and alightings at North Station, South Station, and Back Bay were conducted in February, 1989, prior to the fare increase, and in October 1989, after the fare increase. Nearly all trips, except some late night trips, were counted.

On trips where counts were conducted, conductor figures from the same dates were updated to reflect observed ridership, and factors were developed relating observed ridership to conductor count data. Then, for the late night trips that were not counted, conductor counts were factored up or down based on the comparison of actual to estimated ridership on observed trips. This same process was used for both the before and after counts.

Other Influencing Factors

In addition to the use of available secondary count data to adjust and verify the before and after ridership estimates, other factors that could influence these ridership estimates were examined. These include factors such as seasonal ridership variations, changes in transit service, regional employment changes, the opening or closing of major residential and non-residential developments, and any special events (sporting events, conventions, concerts). The impact of these factors is discussed in detail in Chapter 8.

8. Impacts of the Fare and Parking Fee Increases

FACTORS INFLUENCING MBTA RIDERSHIP

At the simplest level, people ride the MBTA for one of two reasons: (1) it is preferable to other travel options, or (2) they have no other travel alternative. On this basis, total ridership on the MBTA is then a function of its market penetration (the percentage of the total travel market that rides the MBTA for either reason), and the size of the total market. Changes to either variable will likely result in changes in MBTA ridership.

On a more detailed level, there are a number of factors that affect the attractiveness of MBTA service and the size of the total market. As listed below, changes that affect the attractiveness of MBTA service generally are based on cost and/or convenience, while changes in the size of the overall market are based on demographic factors.

Changes Affecting Costs
- Fares
- Gas Prices
- Parking Costs
- Tolls (Bridge, Tunnel and Highway)

Changes Affecting Convenience
- Travel Times
- Level of Service
- Quality of Service
- Parking Supply
- Automobile Availability
- Traffic Congestion

Demographic Changes
- Population Density
- Economic Conditions (including employment, cost of housing, location of affordable housing, etc.)
- Land Use
- Percent of Residents in Workforce

Of these factors, only fares, parking fees, parking supply, service levels, the quality of service, and to a lesser extent, travel times, are under the control of the MBTA. However, these factors usually have the greatest short-term impact of ridership. For example, the 1981 fare increase and concurrent service cuts resulted in a significant ridership decrease. More recently, large improvements in the quality of commuter rail service (new equipment/reduced crowding) has resulted in large increases in commuter rail ridership (53 percent between 1986 and 1988[25]). In addition, improvements in bus and rapid transit service have improved service on those modes also, as evidenced by MBTA surveys of passengers which show that 92 percent of all riders are now satisfied with service, as opposed to 50 percent in 1981.

Changes in other factors usually occur slowly and/or only affect certain market segments. Examples of these are increases in parking costs in certain areas (such as downtown Boston), normal fluctuations in gas prices, population changes and changes in economic conditions. (The gasoline shortages and resulting price increases in the early seventies and eighties were exceptions that did result in significant short-term impacts.)

Since 1982, changes in most factors have worked to increase MBTA ridership:

- Until the 1989 fare increase, fares had remained stable, and therefore have decreased relative to other costs.
- Downtown Boston parking costs have been increasing faster than inflation.
- Tolls on the Callahan/Sumner Tunnels have been increased from 60¢ to $1.00 and tolls on the Mass Turnpike tolls are scheduled to be increased by an average of 30 percent in the Spring of 1990.
- There has been an large growth in jobs in downtown Boston, as well as a large growth in the workforce in the MBTA district.
- Traffic congestion has generally worsened, thus making travel times of transit services with exclusive rights-of-way more competitive.

The one major exception has been gas prices, which, when measured in constant dollars, had declined throughout most of the 1980's. However, the combination of other factors, coupled with MBTA service improvements and expansion and facility modernization efforts, has had more of an impact than declining gas prices, and has resulted in a continual increase in ridership since 1982, averaging 3.5 percent per year.

Prior to the fare and parking fee increases, these ridership increases had resulted in system-wide parking shortages, with all of the MBTA's major

[25]Includes ridership on Fairmount and Needham lines, which began service in 1987, and account for 16 percent of the increase.

rapid transit parking lots, with the exception of Alewife, and most commuter rail lots, at or above capacity. Recent estimates project actual parking demand for rapid transit at up to 13,900 more spaces than the 16,858 spaces that now exist.[26] These parking shortages have effectively constrained the capacity of the MBTA system and have resulted in unmet transit demand – many potential riders do not use the MBTA do not because they cannot access it.

As with existing riders, most of those that would use the MBTA if more parking were available would be expected to continue to do so at moderately higher fare levels and parking costs. Therefore, some of the impacts of the 1989 fare increase have likely been offset by the effects of current parking shortages – that is, although some existing riders will stop using the MBTA because of higher fares, their place will be taken by someone who previously could not access it but was willing to pay a higher cost.

Nearly all of the changes in ridership that have occurred between the Spring of 1989 and the Fall of 1989 appear to be the result of the fare and parking fee increases, parking shortages at MBTA lots, normal seasonal ridership variations and service improvements.[27] There have been no large, sudden changes in any of the external factors that could lead to identifiable changes in overall MBTA ridership. For example, changes in parking fees usually occur on a lot by lot basis, and not throughout the whole city at the same time, and toll increases impact only certain segments of MBTA ridership.

Also, when changes occur gradually, it is usually not possible to accurately separate the impacts of single factors from the combined impacts of all factors. Further, because the time span for measuring the impact of the fare increase was short, the impacts of changes in most factors cannot be measured because data is not available to do so. For example, information on many of the external factors, such as land use changes, downtown Boston parking costs, etc., are not available on a month-to-month basis. On this basis, impacts on MBTA ridership of other factors have been estimated only in cases where distinct, identifiable changes have occurred that impact all ridership, and where necessary data was available. These and other impacts, as well as those of the fare increase itself, are discussed in the following sections.

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[26]CTPS draft Technical Memorandum, "Rapid Transit Patronage and Parking Estimates," William Massicott, Pamela Sears, Ronald Shimizu, August 21, 1989.

[27]In FY 1990, the MBTA instituted a number of bus route changes and consolidations, and eliminated four routes. However, these changes occurred on December 30, 1989, after the period examined in this study, and therefore do not affect, nor or they related to, the figures contained in this report.

Impact of Daily and Seasonal Ridership Variations and Pre-Existing Growth Rates

Transit ridership varies by time of year, by day of week, and based on a number of other factors such as weather conditions, traffic conditions, and special events. Typically, ridership is lower in the summer due to vacations, and Monday and Friday ridership is often lower than mid-week ridership. Also, daily ridership can vary on any given day throughout the year due to sporting events and concerts, and especially during the winter due to weather conditions. Because the project schedule required that "before" and "after" ridership counts be conducted during different months, and for commuter rail, during different days of the week, it was necessary to separate normal seasonal and daily ridership variations, and changes caused by special events, from changes caused by the fare increase.

Daily Variations

On rapid transit, the surface Green Line, and buses, sampling was spread throughout the week to take into account daily variations. However, on commuter rail, before and after sampling was conducted over a period of two or three days due to scheduling constraints. Before counts were conducted on Wednesday, February 8 and Wednesday February 15, while after counts were conducted on Friday, October 13, Monday, October 16, and Monday October 23.

Since counts were conducted over a short period of time, an analysis was conducted to determine whether ridership varied significantly by day. This was done using MBTA commuter rail conductor count data. As described in Chapter 6, conductors counts are ridership estimates that are made on-board each train, and often, due to time constraints, they are estimates rather than actual counts. In general, these estimates are higher than actual counts. (For example, conductors estimated average weekday ridership at 72,320 trips in October 1989, compared with the actual counts that showed 60,720 trips.) However, although conductors counts are high, they are performed by the same conductors using the same method throughout the year. Therefore, they are useful for tracking trends in ridership and monthly and daily variations in ridership. For February 1989 and October 1989, average weekday ridership, as estimated by train conductors, varied by only a very small degree (see Table 8-1). There were no days with significantly higher or lower average ridership, and ridership varied from the norm between only -2.2 percent and + 1.6 percent.

In addition to ridership variations by day of week, there are also variations in ridership on the same day (i.e., Monday, Tuesday, etc.) from week to week. This type of variability is normal with any type of transportation, but, during similar seasons, this variation should be relatively small (with the exception of major events such as snow storms, system breakdowns, etc.).

Since there were no extraordinary weather conditions or breakdowns during the before and after sampling, observed ridership should be typical of those periods. The variation in ridership between weekdays was small and within the range that would be expected on the same day from week to week. Therefore, specific adjustments for daily variations were not made.

Table 8-1
Commuter Rail Conductor Counts - Average Ridership by Weekday

	February 1989		October 1989	
	Total	% of Norm	Total	% of Norm
Average Weekday	71,372	100.0%	72,320	100.0%
Average Monday	69,807	97.8%	71,532	98.9%
Average Tuesday	70,400	98.6%	71,779	99.4%
Average Wednesday	71,872	100.7%	72,670	100.5%
Average Thursday	72,275	101.2%	72,556	100.3%
Average Friday	72,503	101.6%	73,395	101.5%

Special Events

Over the course of a year, transit serves a number of special events, the largest and most frequent of these being Bruins, Celtics, Patriots and Red Sox games, as well as all other events at Boston Garden. Even though these events are seasonal in nature, a similar number occur during each month of each year. Therefore, sampling that is spread out over a number of days throughout a month, as was the case with the rapid transit, surface Green Line and bus counts, captures the impact of these events. However, as previously mentioned, commuter rail sampling was conducted over a period of two to three days. During the before counts, there was a weekday afternoon ice show and a weeknight Celtics game at Boston Garden, while during the after counts, there were no special events.

Since the before counts included Garden events that occur less frequently than every three days, they overstate average ridership. At the same time, since the after counts did not include a Boston Garden event, they understate average ridership. Based on the change in ridership observed in the before and after counts on trains where ridership was not impacted by Garden events, and comparing it to the change in ridership on trains operating before and after Garden events, it was estimated that 500 riders were travelling to or from those events. Since the total impact of these events over the course of a year or an average month is not known, the 500 riders estimated to be using commuter to and from the two Boston Garden events were deducted from

the before counts. This results in a consistent figure from which to compare before and after ridership, but does understate ridership to the extent that commuter rail is used for Boston Garden and other sporting events.

Seasonal Variations and Pre-Fare Increase Growth Trends

Seasonal variations are caused by a number of factors (such as the number of holidays, vacation periods, holiday shopping, weather, etc.) that remain fairly constant from year to year. To determine the impact of seasonal variations, monthly bus, rapid transit, and commuter rail ridership was tracked over the period January 1983 through December 1988 (representing each of the six years between fare changes). These figures show a strong relationship between the time of year and ridership levels. This relationship is displayed in Tables 8-2, 8-3, and 8-4, by comparing average weekday ridership during each month to average weekday ridership for the whole year. (Average weekday ridership for the year is defined as total weekday ridership for the year divided by the number of weekdays in the year, while average weekday ridership for the month is defined as total weekday ridership for the month divided by the number of weekdays in the month. For example, for all of 1988, weekday rapid transit ridership averaged 432,000 trips per weekday, but in October 1988, averaged 462,000, or 106 percent of the yearly norm.) The monthly ridership variation for the months in which counts were conducted are also summarized in Table 8-5.

October, when the after counts were conducted, is usually the highest or second highest ridership month of the year. At the same time, February, March and April, which is when the before counts were conducted, usually experience ridership closer to the average conditions. Therefore, with all other things being equal, October ridership is normally higher than February and April ridership. Using average values for the last six years, rapid transit ridership would have been 5.1 percent higher, bus and surface Green Line ridership 3.1 percent higher, and commuter rail ridership 10.8 percent higher during the after counts than during the before counts.

To account for these seasonal variations, before and after ridership estimates were normalized to provide estimates of average daily ridership on an annual basis. This was done by dividing estimated ridership figures by the percentage in Table 8-5 for the mode and month for which the estimate is made. In effect, this process estimates annual ridership on the basis of the monthly estimates, and then divides that figure by 365. The estimates of average daily ridership for a given month, by comparison, refer to total monthly ridership divided by the number of days in that month. In addition to accounting for seasonal variations, this was also necessary because average daily ridership figures calculated on a monthly basis do not take into account that, from year to year, there are differences in the number of weekdays and weekend days in each month.

Table 8-2
Seasonal Ridership Variations on Rapid Transit Service
(Based on Average Weekday Ridership (in 000s))

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1989													
Ridership	416	435	426	454	442	429							
Change: '88-'89	+1.5%	+1.9%	+1.7%	+5.1%	+2.8%	+1.4%							
1988													
Ridership	410	427	419	432	430	423	428	420	440	462	484	412	432
% of Yearly Average	94.9%	98.8%	96.9%	99.9%	99.5%	97.9%	99.0%	97.2%	101.8%	106.9%	112.0%	95.3%	100.0%
Change: '87-'88	+6.8%	+3.4%	+4.5%	+3.8%	+5.9%	+1.7%	+7.5%	+2.2%	+0.9%	+5.0%	+9.0%	-0.7%	+4.2%
1987													
Ridership	384	413	401	416	406	416	398	411	436	440	444	415	415
% of Yearly Average	92.5%	99.5%	96.6%	100.2%	97.8%	100.2%	95.9%	99.0%	105.1%	106.0%	107.0%	100.0%	100.0%
Change: '86-'87	+4.9%	+9.8%	+7.5%	+5.9%	+11.2%	+6.1%	+8.7%	+4.1%	+8.7%	+5.3%	+7.0%	+7.2%	+7.2%
1986													
Ridership	366	376	373	393	365	392	366	395	401	418	415	387	387
% of Yearly Average	94.5%	97.1%	96.3%	101.5%	94.3%	101.2%	94.5%	102.0%	103.6%	107.9%	107.2%	99.9%	100.0%
Change: '85-'86	+5.5%	+0.8%	+0.0%	+1.8%	-0.3%	+4.5%	+0.3%	+8.5%	+7.5%	+5.8%	+5.6%	-1.3%	+3.2%
1985													
Ridership	347	373	373	386	366	375	365	364	373	395	393	392	375
% of Yearly Average	92.5%	99.4%	99.4%	102.9%	97.6%	100.0%	97.3%	97.0%	99.4%	105.3%	104.8%	104.5%	100.0%
Change: '84-'85	+4.2%	+9.7%	+8.4%	+7.8%	+8.0%	+10.6%	+5.2%	+7.7%	+1.9%	+7.6%	+7.1%	+5.7%	+7.0%
1984													
Ridership	333	340	344	358	339	339	347	338	366	367	367	371	351
% of Yearly Average	94.9%	96.9%	98.1%	102.1%	96.7%	96.7%	98.9%	96.4%	104.3%	104.6%	104.6%	105.8%	100.0%
Change: '83-'84	+8.8%	+3.0%	+7.2%	+7.2%	+4.0%	+8.7%	+9.8%	+6.6%	+8.9%	+5.2%	+5.5%	+9.1%	+7.0%
1983													
Ridership	306	330	321	334	326	312	316	317	336	349	348	340	328
% of Yearly Average	93.3%	100.6%	97.9%	101.9%	99.4%	95.1%	96.4%	96.7%	102.5%	106.4%	106.1%	103.7%	100.0%
AVERAGE PERCENTAGE	93.8%	98.7%	97.5%	101.4%	97.5%	98.5%	97.0%	98.0%	102.8%	106.2%	106.9%	101.5%	100.0%
STANDARD DEVIATION	1.1%	1.5%	1.2%	1.1%	1.9%	2.4%	1.8%	2.2%	2.0%	1.2%	2.7%	3.9%	0.0%

Source: MBTA Ridership and Service Statistics, October 1988 and January 1990

Table 8-3
Seasonal Ridership Variations on Bus and Surface Green Line Ridership
(Based on Average Weekday Ridership (in 000s))

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989													
Ridership	428	444	430	466	437	428							
Change: '88-'89	-1.2%	-0.9%	-0.2%	+4.5%	-0.9%	+1.7%							
1988													
Ridership	433	448	431	446	441	421	411	397	440	463	487	404	435
% of Yearly Average	99.5%	102.9%	99.0%	102.5%	101.3%	96.7%	94.4%	91.2%	101.1%	106.4%	111.9%	92.8%	100.0%
Change: '87-'88	+1.9%	-3.2%	-2.3%	+0.5%	-1.3%	-4.8%	+1.5%	-2.5%	-4.6%	+1.3%	+5.4%	-4.0%	-1.0%
1987													
Ridership	425	463	441	444	447	442	405	407	461	457	462	421	440
% of Yearly Average	96.7%	105.3%	100.3%	101.0%	101.7%	100.5%	92.1%	92.6%	104.9%	104.0%	105.1%	95.8%	100.0%
Change: '86-'87	-1.8%	+3.8%	-1.8%	-4.3%	+0.9%	+1.4%	+4.7%	-2.4%	+2.9%	-3.2%	-1.5%	-0.9%	-0.3%
1986													
Ridership	433	446	449	464	443	436	387	417	448	472	469	425	441
% of Yearly Average	98.2%	101.2%	101.9%	105.3%	100.5%	98.9%	87.8%	94.6%	101.6%	107.1%	106.4%	96.4%	100.0%
Change: '85-'86	+2.6%	-3.0%	+0.0%	+2.4%	+0.9%	+1.2%	-5.1%	+3.0%	+2.3%	+2.6%	+2.9%	-2.5%	+0.6%
1985													
Ridership	422	460	449	453	439	431	408	405	438	460	456	436	438
% of Yearly Average	96.3%	105.0%	102.5%	103.4%	100.2%	98.4%	93.1%	92.4%	100.0%	105.0%	104.1%	99.5%	100.0%
Change: '84-'85	-10.6%	-3.6%	+3.5%	+1.8%	-1.3%	-0.5%	-0.7%	-0.2%	-4.2%	-0.4%	-1.1%	-2.7%	-1.8%
1984													
Ridership	472	477	434	445	445	433	411	406	457	462	461	448	446
% of Yearly Average	105.8%	107.0%	97.3%	99.8%	99.8%	97.1%	92.2%	91.0%	102.5%	103.6%	103.4%	100.5%	100.0%
Change: '83-'84	+7.0%	+0.4%	-4.8%	-6.1%	-4.5%	-0.7%	-4.0%	-2.6%	-1.1%	-4.1%	-5.1%	-1.8%	-2.3%
1983													
Ridership	441	475	456	474	466	436	428	417	462	482	486	456	457
% of Yearly Average	96.6%	104.0%	99.9%	103.8%	102.1%	95.5%	93.7%	91.3%	101.2%	105.6%	106.4%	99.9%	100.0%
AVERAGE PERCENTAGE	98.9%	104.2%	100.2%	102.6%	100.9%	97.9%	92.2%	92.2%	101.9%	105.3%	106.2%	97.5%	100.0%
STANDARD DEVIATION	3.6%	2.0%	1.9%	2.0%	0.9%	1.8%	2.3%	1.3%	1.7%	1.4%	3.0%	3.0%	0.0%

Source: MBTA Ridership and Service Statistics, October 1988 & January 1990

Table 8-4
Seasonal Ridership Variations on Commuter Rail
(Based on Average Weekday Ridership)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1989													
Ridership	70,919	68,378	71,520	65,835	68,774	71,288	62,853	71,391	67,830	72,332	69,515		
Change: '87-'88	+23.5%	+6.2%	+7.2%	+5.1%	+12.3%	+7.3%	+4.9%	+4.3%	-0.5%	+8.6%	+4.0%		
1988													
Ridership	57,405	64,390	66,715	62,643	61,266	66,456	59,893	68,474	68,185	66,629	66,810	66,929	64,649
% of Yearly Average	88.8%	99.6%	103.2%	96.9%	94.8%	102.8%	92.6%	105.9%	105.5%	103.1%	103.3%	103.5%	100.0%
% of Yearly Average	+18.7%	+23.1%	+26.4%	+17.5%	+26.1%	+22.3%	+12.8%	+35.1%	+26.6%	+16.0%	+20.9%	+10.6%	+21.1%
1987													
Ridership	48,352	52,298	52,771	53,333	48,566	54,353	53,114	50,669	53,865	57,447	55,239	60,536	53,379
% of Yearly Average	90.6%	98.0%	98.9%	99.9%	91.0%	101.8%	99.5%	94.9%	100.9%	107.6%	103.5%	113.4%	100.0%
Change: '86-'87	+0.5%	+6.2%	+60.4%	+70.9%	+42.6%	+19.7%	+16.7%	+9.4%	+10.5%	+9.6%	+24.0%	+24.6%	+21.5%
1986													
Ridership	48,095	49,258	32,907	31,211	34,065	45,397	45,520	46,335	48,767	52,428	44,555	48,566	43,925
% of Yearly Average	109.5%	112.1%	74.9%	71.1%	77.6%	103.4%	103.6%	105.5%	111.0%	119.4%	101.4%	110.6%	100.0%
Change: '85-'86	+14.4%	+19.2%	-18.6%	-28.0%	-20.0%	+9.4%	+5.6%	+5.4%	+14.7%	+8.4%	+7.4%	+5.2%	+2.0%
1985													
Ridership	42,045	41,325	40,415	43,358	42,603	41,496	43,118	43,976	42,516	48,352	41,496	46,164	43,072
% of Yearly Average	97.6%	95.9%	93.8%	100.7%	98.9%	96.3%	100.1%	102.1%	98.7%	112.3%	96.3%	107.2%	100.0%
Change: '84-'85	+2.2%	+4.4%	-2.1%	+6.8%	+4.4%	+0.2%	+9.7%	+4.2%	+9.6%	+10.5%	+3.1%	+23.5%	+6.2%
1984													
Ridership	41,144	39,579	41,273	40,609	40,801	41,407	39,299	42,217	38,792	43,761	40,255	37,369	40,542
% of Yearly Average	101.5%	97.6%	101.8%	100.2%	100.6%	102.1%	96.9%	104.1%	95.7%	107.9%	99.3%	92.2%	100.0%
Change: '83-'84	+2.1%	-5.6%	-5.9%	+1.9%	+4.3%	-1.6%	+4.0%	+0.0%	-9.1%	+4.4%	-3.8%	-12.3%	-2.0%
1983													
Ridership	40,286	41,943	43,847	39,856	39,128	42,072	37,798	42,217	42,693	41,916	41,851	42,603	41,351
% of Yearly Average	97.4%	101.4%	106.0%	96.4%	94.6%	101.7%	91.4%	102.1%	103.2%	101.4%	101.2%	103.0%	100.0%
AVERAGE PERCENTAGE	95.2%	98.5%	100.7%	98.8%	96.0%	101.0%	96.1%	101.8%	100.8%	106.5%	100.7%	103.9%	100.0%
STANDARD DEVIATION	5.3%	2.1%	4.6%	2.0%	3.8%	2.6%	3.9%	4.2%	3.8%	4.3%	3.0%	7.7%	0.0%

Note: Commuter Rail strike from March - May 1986. Averages and STDs exclude strike year.

*Source: MBTA Railroad Operations Monthly Ridership/No of Days In Month*1.33 Ratio of Avg Weekday to Avg Daily Ridership.*

Table 8-5
Variations in Average Weekday Ridership by Month
(as a Percent of Annual Norm)

	February	March	April	October	November
Rapid Transit					
% of Yearly Average		97.5%	101.4%	106.2%	106.9%
Standard Deviation		1.2%	1.1%	1.2%	2.7%
Maximum		107.9%	102.9%	107.9%	112.0%
Minimum		96.3%	99.9%	104.6%	104.6%
Surface Green Line & Bus					
% of Yearly Average		100.2%	102.6%	105.3%	106.2%
Standard Deviation		1.9%	2.0%	1.4%	3.0%
Maximum		102.5%	105.3%	107.1%	111.9%
Minimum		97.3%	99.8%	103.6%	103.4%
Commuter Rail					
% of Yearly Average	98.5%			106.5%	
Standard Deviation	2.1%			4.3%	
Maximum	101.4%			112.3%	
Minimum	95.9%			101.4%	

Note that this method does not eliminate the impact of ridership trends that had been occurring over the given period. Implicit within these figures are the impacts of all ridership changes that have occurred between 1983 and 1989, including the impacts of changes that cannot be estimated separately such as downtown Boston parking costs, land use changes, gas price fluctuations, changes in traffic congestion, etc. (On rapid transit and commuter rail, there have been consistent increases, while surface ridership has been declining slightly.)

To determine how many existing riders were lost as a result of the fare increase, it was necessary to separate the impact of growth (or losses) that would have occurred had the fare increase not occurred from seasonal variations. As indicated in Tables 8-2 and 8-3, rapid transit ridership increased at an average annual rate of 6.3 percent, and surface ridership had been declining at an average rate of 1.0 percent per year. A continuation of these trends would mean that without the fare increase, and assuming that all other factors remained equal, rapid transit ridership would have continued to increase, and surface would have continued to decline slightly. If this growth occurred at a constant rate throughout the year, then in the six and one-half months between April and the end of November 1989, rapid transit ridership would have increased by 3.4 percent, and surface ridership would have declined by 0.5 percent. To eliminate the impact of trends that were occurring before the fare increase, these growth rates were deducted

from the combined seasonal variation/ongoing growth figures calculated as described above.

(As an example, April rapid transit ridership is typically slightly higher than "normal" at 1.4 percent above the yearly average. (For April, the increase above average largely includes growth that had occurred since the beginning of the year.) To make the April ridership figure representative of average daily ridership for the year (as opposed for the single month), April ridership would be divided by a factor of 1.014 to provide an "annualized" figure. In this case, the growth that occurred between January and April is included because April ridership is used as the base. For after ridership, without the fare increase, rapid transit ridership would have been expected to have continued to increase. Since 1983, the average annual rate of growth on rapid transit ridership has been 6.3 percent. Assuming that this growth rate was occurring at a constant rate, then the expected growth between the middle of April 1989 and the end of October would have been approximately 3.4 percent, or 54 percent of the 5.1 percent ridership differences that had been observed since 1983 between April and the end of October.[28] The other 1.7 percent would be attributable to the actual seasonal variation that occurs between April and the end of October. Therefore, without the fare increase, and without on-going growth, end of October rapid transit ridership would be expected to be similar to April ridership, or 1.7 percent higher than average for the year. To annualize end of October ridership, actual ridership would be divided by 1.017.)

Impact of the Parking Fee Increase

Rapid transit and surface Green Line counts were conducted during the last two weeks of October and the first two weeks of November. This means that roughly half of the counts were conducted before the parking fee increase and roughly half were conducted after the parking fee increases went into effect. As a result, the resulting ridership figures partially capture the impacts of the parking fee increase.

As discussed later in this chapter, the parking fee increase was estimated to have resulted in a loss of approximately 2,020 trips per day – 1,200 on rapid transit, 630 on the Green Line, and 190 on bus service. To eliminate the

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[28] On a year-by-year basis, annual growth had varied between 3.2 percent and 7.2 percent, and monthly growth had varied from -1.3 percent to + 11.2 percent. Over the past year, growth appeared to have slowed slightly, but was still well with the range of observed values of growth since 1983, and within the range of variation that had occurred in that time period. Also, the growth rate used is consistent with the seasonal variation factors used - if a lower growth rate were used, then the difference between October and April ridership levels would also need to be decreased.

impact of the parking fee increase from the fare increase impacts, half of the losses attributed to the parking fee increases (600 rapid transit trips, 340 surface Green Line trips) have been added back into the "after" totals. These trips were added to adult cash and adult pass categories proportionally to observed ridership in those groups.

PROJECTED RIDERSHIP IMPACTS OF THE FARE AND PARKING FEE INCREASES

When the fare increases were implemented, the MBTA had projected an overall ridership loss of between 1.0 and 2.6 percent on the rapid transit, the surface Green Line and buses, or between 7,230 to 17,680 trips per day. On commuter rail, expected losses were 4.2 to 10.2 percent, or 1,950 to 4,730 trips per day. The overall loss on all modes due to the fare increase was expected to be between 1.2 and 3.0 percent, or 9,180 to 22,410 trips per day. (These projections are presented in more detail in Appendix B.)

Prior to the fare and parking fee increases, ridership increases had resulted in systemwide parking shortages, with all MBTA rapid transit parking lots, except Alewife, and most commuter rail lots, at or above capacity. These parking shortages effectively constrain the capacity of system and result in unmet transit demand. Recent estimates had also projected actual parking demand for rapid transit at up to 13,900 more spaces than the 16,858 spaces that now exist. As a result, losses in parking lot usage from existing riders were expected to be offset by new usage by those that previously could not find space available, and no significant net ridership impact was expected.

OBSERVED IMPACTS OF THE FARE INCREASE

As originally expected, the fare increase has resulted in some losses in rapid transit ridership. However, at the same time, surface Green Line and bus ridership increased, so that the overall ridership loss was small. Between April 1989 and the end of October 1989, rapid transit ridership declined approximately 3.3 percent, surface Green Line ridership increased 6.3 percent, and bus ridership increased 1.4 percent. Overall "basic" system ridership has declined 0.5 percent due to the fare increase. Commuter rail ridership continued to increase in spite of the fare increase, although at a slower rate than in previous years.

These ridership figures represent a change in the trends that had been occurring since 1983, where rapid transit had been steadily increasing and surface ridership had been slightly declining. The fare increase has, at least temporarily, reversed these trends.

The fare increase, combined with the new pass structure, has also resulted in a greater percentage of riders purchasing passes and fewer paying cash. Overall pass sales have increased 3.5 percent between October 1988 and October 1989, and increases occurred in nearly all pass types. This was true even on rapid transit, where although total ridership declined, pass ridership increased slightly.

Rapid Transit Ridership and Revenue

Using the sampling procedure described in Chapter 5, actual April 1989 rapid transit ridership was estimated at 354,240 trips per day[29] (see Table 8-6). At the end of October 1989, ridership was estimated at 347,350 trips per day, or 2.0 percent lower than in April.

However, since 1983, end of October ridership had averaged 5.1 percent higher than April ridership. This had been the case for two reasons: (1) more persons historically use transit in the Fall than in the Spring, and (2) because ongoing growth has attracted new riders to the system each month. As described further below, when normal seasonal variations are taken into account, the loss of existing ridership was slightly higher, at approximately 3.3 percent. In addition, when loss of ridership growth is considered, the decline was as high as 6.8 percent.

Since the last fare changes in 1983, April ridership has been slightly higher than "normal" for the year, at 101.4 percent of the yearly average. This has been largely due to growth that has occurred from January through April each year since 1983. Based on the ridership trends had been occurring prior to the fare increase, then actual April ridership of 354,240 passenger trips was indicative of an annualized average daily ridership level of 349,350 trips (see Table 8-7).

Without the fare increase, ridership would have been expected to have continued to increase. As previously mentioned, the average annual rate of growth on rapid transit ridership since 1983 has been 6.3 percent.[30] Using this growth rate between April 1989 and the end of October, expected ridership over that period would have been approximately 3.4 percent, or two-thirds of the 5.1 percent ridership difference that had been observed since 1983 between April and the end of October. The other 1.7 percent would be attributable to the actual seasonal variation, exclusive of growth, that occurs between April and the end of October. Therefore, without the fare increase, and without

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[29]This and subsequent "per day" ridership figures are a weighted average of weekday, weekend and holiday ridership. They should not be confused with average weekday ridership.

[30]Excluding 1986, in which there was a commuter rail strike that also affected rapid transit ridership.

Table 8-6
Actual Daily Ridership Before and After the Fare Increase

	Adult Cash	Adult Pass	E&H	Student Half	Student Pass	Auth Free	Unauth Free	Farebox Deposit Per Pax	Daily Farebox Deposits	Daily Ridership
APRIL 1989										
Surface Green Line										
Ridership	24,087	19,592	3,757	805	335	18,451	67	$0.316	$21,202	67,095
Percent of Mode	35.9%	29.2%	5.6%	1.2%	0.5%	27.5%	0.1%			
Bus/Trackless Trolley										
Ridership	108,793	95,477	33,998	21,815	9,633	12,749	850	$0.231	$65,446	283,316
Percent of Mode	38.4%	33.7%	12.0%	7.7%	3.4%	4.5%	0.3%			
Total Surface										
Ridership	132,880	115,069	37,755	22,620	9,968	31,200	917	$0.247	$86,648	350,411
Percent of Mode	37.9%	32.8%	10.8%	6.5%	2.8%	8.9%	0.3%			
Total Rapid Transit										
Ridership	166,597	127,477	35,562	6,318	8,307	9,298	684	$0.312	$110,683	354,243
Percent of Mode	47.0%	36.0%	10.0%	1.8%	2.3%	2.6%	0.2%			
Total Basic System										
Ridership	299,477	242,546	73,318	28,939	18,275	40,498	1,601	$0.280	$197,331	704,654
Percent of Mode	42.5%	34.4%	10.4%	4.1%	2.6%	5.7%	0.2%			
END OF OCTOBER 1989										
Surface Green Line										
Ridership	26,909	18,771	3,275	437	509	23,070	146	$0.346	$25,298	73,117
Percent of Mode	36.7%	25.6%	4.5%	0.6%	0.7%	31.7%	0.2%			
Bus/Trackless Trolley										
Ridership	102,374	107,907	39,480	22,687	10,018	11,490	589	$0.240	$70,691	294,545
Percent of Mode	34.7%	36.6%	13.4%	7.7%	3.4%	3.9%	0.2%			
Total Surface										
Ridership	129,283	126,678	42,755	23,124	10,527	34,561	735	$0.261	$95,989	367,662
Percent of Mode	35.1%	34.4%	11.6%	6.3%	2.9%	9.4%	0.2%			
Total Rapid Transit										
Ridership	158,492	129,422	34,983	6,287	8,397	9,023	640	$0.378	$131,176	347,243
Percent of Mode	45.6%	37.2%	10.1%	1.8%	2.4%	2.6%	0.2%			
Total Basic System										
Ridership	287,775	256,100	77,738	29,410	18,924	43,584	1,375	$0.318	$227,165	714,906
Percent of Mode	40.2%	35.8%	10.9%	4.1%	2.7%	6.1%	0.2%			

including on-going growth, end of October rapid transit ridership would be expected to be similar to April ridership, or 1.7 percent higher than average for the year. On an annualized basis, actual October ridership was representative of an average ridership level of 337,820 trips per day. This is 3.3 percent, or 11,530 daily rapid transit trips lower than annualized April figures.

The fare increase has resulted in a reversal of ridership growth that had been occurring since the last fare changes. Therefore, in addition to a loss of existing riders, another impact of the fare increase was some ridership growth was foregone. At pre-existing levels of ridership growth, ridership would have grown by up to 3.4 percent between April and the end of October, or by up to 11,920 daily trips. These trips that were not attracted would represent a loss of an additional 3.4 percent, and when combined with the loss of existing riders, would represent a loss of 6.7 percent.

In addition to the ridership loss, there were also changes in the proportions of riders paying different fare types (see also Table 8-7). The largest declines were in the number of adult cash riders, while adult pass ridership increased slightly in absolute numbers and held steady on an annualized basis. Before the fare increase 47 percent of all rapid transit riders paid adult cash fares and 36 percent used adult passes; after the fare increase, the proportion of riders paying adult cash fares declined to 46 percent, and the proportion using adult passes increased to 37 percent. The proportions of elderly riders, riders disabilities and student and child riders remained constant.

On a percentage basis, adult cash ridership declined 4.9 percent between April and October, while adult pass ridership increased 1.5 percent. The relatively large loss in adult cash ridership and the slight increase in pass riders indicates that the fare increase, in conjunction with the new pass program, has encouraged some former cash riders to begin purchasing passes.

Essentially no change was observed in student ridership on rapid transit. Between April and the end of October, student and child ridership was up 0.4 percent. The number of elderly riders and those with disabilities declined two to three percent. However, since fares for nearly all of these riders were not increased, this change cannot be attributed to the fare increase. This change may reflect a normal seasonal change (however, this cannot be confirmed since similar studies have not previously been conducted during the same months).

As a result of the fare increase, the average fare paid by non-pass users on rapid transit has increased 24 percent from 53¢ to 66¢. For the four-week period from April 1 to April 28, 1989, the MBTA collected a total of $3.1 million in rapid transit fare revenue, while in the four-week period October 21 to November 17, 1989, a total of $3.7 million was collected. Therefore, in

Table 8-7
Before and After Ridership after Seasonal Adjustments

	Rapid Transit Riders			Surface Green Line			Bus and Trackless Trolley			Total			
	Actual Ridership	Adjusted Riders	Percent	Actual Ridership	Adjusted Riders	Percent	Actual Ridership	Adjusted Riders	Percent	Actual Ridership	Percent	Total Adj Riders	Percent
Adult Cash													
Before	166,597	164,297	23.8%	24,087	23,477	3.4%	108,793	106,036	15.3%	299,477	42.5%	293,810	42.5%
After	158,492	154,356	22.5%	26,909	25,573	3.7%	102,374	97,382	14.2%	287,775	40.3%	277,311	40.3%
Change	-8,105	-9,941		+2,822	+2,096		-6,419	-8,654		-11,702		-16,499	
% Change	-4.9%	-6.1%		11.7%	8.9%		-5.9%	-8.2%		-3.9%		-5.6%	
Adult Pass													
Before	127,477	125,717	18.2%	19,592	19,095	2.8%	95,477	93,058	13.5%	242,546	34.4%	237,870	34.4%
After	129,422	125,756	18.3%	18,771	17,854	2.6%	107,907	102,544	14.9%	256,100	35.8%	246,154	35.8%
Change	+1,945	+39		-821	-1,241		+12,430	+9,486		+13,554		+8,283	
% Change	1.5%	0.0%		-4.2%	-6.5%		13.0%	10.2%		5.6%		3.5%	
Elderly & Disabled													
Before	35,562	35,071	5.1%	3,757	3,662	0.5%	33,998	33,136	4.8%	73,318	10.4%	71,870	10.4%
After	34,983	34,029	5.0%	3,275	3,117	0.5%	39,480	37,513	5.5%	77,738	10.9%	74,659	10.9%
Change	-579	-1,042		-482	-545		+5,482	+4,376		+4,420		+2,789	
% Change	-1.6%	-3.0%		-12.8%	-14.9%		16.1%	13.2%		6.0%		3.9%	
Student/Child													
Before	14,625	14,423	2.1%	1,141	1,112	0.2%	31,448	30,651	4.4%	47,214	6.7%	46,186	6.7%
After	14,683	14,273	2.1%	946	901	0.1%	32,705	31,093	4.5%	48,334	6.8%	46,266	6.7%
Change	+58	-150		-195	-211		+1,257	+442		+1,120		+80	
% Change	0.4%	-1.0%		-17.1%	-19.0%		4.0%	1.4%		2.4%		0.2%	
Free													
Before	9,982	9,844	1.4%	18,518	18,049	2.6%	13,599	13,255	1.9%	42,099	6.0%	41,148	6.0%
After	9,663	9,405	1.4%	23,216	22,051	3.2%	12,080	11,495	1.7%	44,959	6.3%	42,951	6.2%
Change	-319	-439		+4,698	+4,003		-1,520	-1,760		+2,860		+1,804	
% Change	-3.2%	-4.5%		25.4%	22.2%		-11.2%	-13.3%		6.8%		4.4%	
Total													
Before	354,243	349,352	50.6%	67,095	65,395	9.5%	283,316	276,136	40.0%	704,654	100.0%	690,884	100.0%
After	347,243	337,819	49.1%	73,117	69,496	10.1%	294,545	280,026	40.7%	714,906	100.0%	687,340	100.0%
Change	-7,000	-11,534		+6,022	+4,101		+11,229	+3,889		+10,252		-3,543	
% Change	-2.0%	-3.3%		9.0%	6.3%		4.0%	1.4%		1.5%		-0.5%	

addition to the 3.3 percent ridership loss and the shift from cash to pass ridership, the fare increase has resulted in a 19.4 percent increase in rapid transit cash and token revenue. However, as with ridership, revenue is also normally above average in October and November and higher than in April. On an annualized basis, the increase is approximately 18.5 percent.

Rapid transit pass sales have also increased from April 1989 to October 1989, and from October 1988 to October 1989. A total of 59,438 Subway passes were sold in October 1989, compared to 57,179 B passes in April 1989, and 54,272 B passes in October 1988. Year-to-year figures from October 1988 to October 1989 indicate an increase in B/Subway pass sales of 5.4 percent. April 1989 to October 1989 B/Subway pass sales, after making seasonal adjustments were 3.4 percent higher. Since rapid transit pass ridership remained constant, this indicates that many of the new pass purchasers are making fewer trips per month than prior pass holders. This is consistent with the figures that estimate that former cash riders have shifted to pass use, since those shifting would be expected to be those for whom pass savings are lowest because they make fewer monthly trips.

Surface Green Line Ridership and Fare Revenue

While rapid transit ridership decreased, surface Green Line ridership increased from 67,100 daily trips in April 1989 to 73,120 trips per day by the end of October 1989. This was an increase of 6,020 trips per day, or 9.0 percent.[31]

Since 1983, surface transit ridership at the end of October has averaged three percent higher than in April. This has been in spite of gradual decreases in surface ridership that have averaged 1.0 percent per year over the same time period. When this rate of decline is deducted from the observed seasonal variation, end of October ridership would be expected to be 3.5 percent higher than in April due to seasonal variations alone. When both April and October ridership figures are annualized using the appropriate seasonal adjustments, the observed ridership figures represent annualized average daily ridership of 65,400 trips in April and 69,500 trips per day at the end of October. On this basis, Green Line ridership has increased by 4,100 trips per day, or 6.3 percent.

Since ridership had previously been declining on surface transit, much, or most, of the observed 4,100 trips per day increase may be attributable to riders shifting from rapid transit. Further, ongoing declines in surface ridership

[31]Surface Green Line trips are considered to be those that begin on the surface, inbound or outbound. This includes inbound trips beginning on the surface and ending in the subway (including Science Park or Lechmere), but does not include outbound trips beginning in the subway and ending on the surface (those trips are considered rapid transit trips).

would have likely continued had rapid transit fare increase not occurred. Based on trends since 1983, the decline between April 1989 and the end of October 1989 would have been approximately 0.5 percent, or 350 daily trips. Therefore, including these trips, the shift from rapid transit to the surface Green Line could be as high as 4,450 trips per day.

Most of the observed ridership increase was in adult cash and free ridership (nearly all of which was in outbound surface boardings). These increases may partially be the result of a number of factors:

- A seasonal phenomena attributable to large number of college students on the surface Green Line that use the Green Line when they first arrive in the Fall but begin walking when the weather turns warmer in the Spring.

- A shift from rapid transit to the surface Green Line. This would be most likely in areas served by both services, such as Jamaica Plain, Mission Hill, and Roxbury, which are served by both the Green Line and the Orange Line.

- Riders travelling to and from Kenmore Square that paid to board outbound surface Green Line trains at Kenmore prior to the fare increase but now walk the extra distance to free surface stops. These riders would also be more likely to stop using passes, which could partially explain some of the increase in cash riders and the decline pass ridership (which is the opposite of what occurred on other modes).

As indicated by the increases in adult cash ridership and free outbound ridership, there were significant changes in the fare-mix of surface Green Line riders before and after the fare increase. Following the fare increase, the percentage of adult cash riders increased from 36 to 37 percent, the percentage of adult pass users dropped from 29 percent to 26 percent, and the percentage of free riders increased from 28 percent to 32 percent.

Between April and Fall 1989, MBTA surface Green Line revenue has increased by 19.3 percent. After accounting for normally higher fall ridership, this represents an increase of nearly 16 percent over the course of a year. Over the same period, the average fare for non-pass riders has increased 6.2 percent from 45¢ to 47¢. This relatively low increase in the average fare, compared to rapid transit, is because most surface Green Line riders were unaffected by the fare increase (since only adult and student fares on the Riverside Line beyond Fenway Park were increased – fares on the other three surface Green Lines remained unchanged).

Bus Ridership and Fare Revenue

Bus ridership showed an increase between April and October of 11,230 trips per day, or 4.0 percent, from 283,320 trips per day to 294,550 per day. Making the same seasonal adjustments to bus service as for the surface Green Line, these figures represent annualized ridership of 276,140 trips per day in April and 280,030 trips per day at the end of October. On an annualized basis, bus and trackless trolley ridership has increased approximately 1.4 percent, or by 3,890 trips per day. This increase is relatively small, but does represent a reversal of the downward trends that had occurred in prior years. However, since bus service between April and October was relatively unchanged, and express bus fares were increased, these gains, as with the surface Green Line gains, likely represent a shift from rapid transit rather than new ridership.

Also, as mentioned above for the surface Green Line, surface transit ridership had been declining, and it is likely that ongoing declines in surface ridership would have continued had rapid transit fare increase not occurred. Based on trends since 1983, the decline between April 1989 and the end of October 1989 would have been approximately 0.5 percent, or 1,500 daily trips. Therefore, including these trips with the observed increase of 3,890 trips, the shift from rapid transit to buses was as high as 5,390 trips per day.

In terms of fare payment, although total bus ridership increased, adult cash ridership declined. From April to October, the decline was 5.9 percent, or 6,420 daily trips; seasonally adjusted, the decline was 8.2 percent, or 8,650 daily trips. At the same time, adult pass ridership increased significantly – up 13.0 percent, or 12,430 daily trips in absolute numbers, and 10.2 percent, or 9,490 trips when seasonally adjusted. Using either measure, adult pass ridership is now higher than adult cash ridership. The decline in adult cash ridership and the gain in adult pass ridership appears to be attributable to two factors: (1) a shift among existing bus riders from cash to pass use due to the revised pass program, and (2) a shift of rapid transit riders to bus service.

Over the same period, bus farebox revenue has increased approximately 8.0 percent, and the average fare for cash and token riders has increased from 40¢ to 43¢. A/Local Bus Pass sales declined between April 1989 and October 1989 from 17,857 A Passes in April to 16,661 Bus Passes in October. However, there was also a similar decline in 1988, and year-to-year figures for both April and October show increases in A/Local Bus Pass sales (two to three percent). These pass figures, combined with before and after count results, also indicate a shift from cash to pass ridership.

Combined Bus and Surface Green Line Ridership

Historically, the MBTA has not tracked bus ridership separately from surface Green Line ridership; instead the two have been combined into the single

category of "surface transit". When the surface Green Line and bus/trackless trolley before and after results are combined, surface transit ridership increased from 350,410 trips per day in April to 367,660 trips per day at the end of October. When seasonally adjusted, these figures indicate that ridership has increased by 7,900 trips per day, or 2.3 percent, from 341,530 trips per day to 349,520 trips.

Commuter Rail Ridership

Commuter rail ridership was estimated at approximately 60,720 trips per weekday in February 1989, and 61,400 trips per weekday in October 1989, or 1.1 percent higher.[32] However, as with rapid transit ridership, October ridership is normally higher than February ridership because it is typically a higher ridership month and because of the ongoing growth. Since 1983, February commuter rail ridership has averaged 98.5 percent of average monthly ridership, and October ridership has averaged 106.5 percent. On this basis, October would normally be expected to be 8.1 percent higher than in February. This figure also includes an implicit annual growth rate of 11.7 percent (average growth since 1983, excluding 1986 strike year). Therefore, 7.8 percent of the 8.1 percent increase between February and October would be attributable to growth. Not including this growth, October ridership would be expected to be approximately 0.3 percent greater than in April. After making these adjustments, actual February ridership represents an average ridership level of 61,650 trips per weekday, and actual October ridership represents an average ridership level of 62,300 trips per weekday, still an increase of 1.1 percent, or 650 trips per weekday. Therefore, the impact of the fare increase on commuter rail ridership has not been a decline in ridership, but instead, a decline in the growth rate.

As previously mentioned, the average annual growth rate since 1983 for commuter rail had been 11.7 percent. However, many large improvements, notably new equipment and expanded capacity, had been implemented between 1986 and 1988, and had already realized their immediate positive impact on ridership. As a result, a lower growth rate of approximately 3.4 percent had been projected for FY 1989. Assuming that this growth would occur at a constant rate throughout the year, growth of 2.3 percent, or 1,420 trips per weekday, would be expected between February and October. Seasonally adjusted, the actual increase was 650 trips per weekday, which was 770 trips per weekday, or 1.2 percent, lower than would have been expected without the fare increase.

[32]For comparison with rapid transit, surface Green Line and bus figures, these weekday figures are indicative of average daily ridership of 46,170 trips per day in February 1989 and 45,650 trips per day in October 1989.

Commuter rail ridership was also counted by line (see Table 8-8). Between February and October, changes by line ranged from -4.2 percent to +5.2 percent. Accounting for normal seasonal variation, October ridership would be expected to be approximately eight percent higher. Therefore, all lines showed lower growth than would have been expected without the fare increase, and three lines on the South Side (Framingham, Needham, and Attleboro/Stoughton) showed actual ridership declines. In total, North Side ridership appeared less affected than did South Side lines.

Table 8-8
Commuter Rail Ridership by Line
(Weekday Ridership)

	February 1989	October 1989	Change	Percent Change
North Side Service				
Rockport/Ipswich	7,372	7,762	*390*	*+5.3%*
Haverhill/Reading	6,005	6,240	*+235*	*3.9%*
Lowell	6,101	6,428	*+327*	*5.4%*
Fitchburg	4,900	5,070	*+170*	*3.5%*
Subtotal North Side	24,378	25,500	*+1,122*	*4.6%*
South Side Service Service				
Framingham	5,812	5,611	*-200*	*-3.4%*
Needham	4,924	4,716	*-207*	*-4.2%*
Franklin	7,711	7,931	*+219*	*2.8%*
Attleboro/Stoughton	16,642	16,270	*-372*	*-2.2%*
Fairmount	1,851	1,990	*+139*	*7.5%*
Subtotal South Side	36,940	36,519	*-421*	*-1.1%*
Total - North & South	***60,721***	***61,398***	***+677***	***1.1%***

Before and After Pass Sales

Between October 1988 and October 1989, total pass sales continued to increase, with year-to-year growth at 3.5 percent. Highest levels of growth were observed in the lower priced passes, while some significant losses occurred with some mid-priced passes. As shown in Table 8-9, there was a slight increase in Bus Pass sales, and fairly large increases in Subway and Combo Pass Sales. At the same time, there were declines in D/Combo Plus and Zone 1, and E/Zone 2 Pass sales. These declines were largely due to changes in the way the pass program was restructured, as described below. Overall, increases

in Subway and Combo Pass sales were larger than declines in Combo Plus, Zone 1 and Zone 2 Passes.

As with ridership count estimates, the increases in pass sales further indicates that that there has been a shift from adult cash ridership to adult pass ridership. The decrease in Combo Plus, Zone 1 and Zone 2 Passes was largely the result of changes in the pass structure, which allowed many former D and E Pass purchasers to switch to the less expensive Combo pass. However, there

Table 8-9
Before and After Pass Sales

Pass Type (Before/After)	October 1988	October 1989	Change	Percent Change
A/Bus	16,388	16,661	+273	+1.7%
B/Subway	54,272	59,438	+5,166	+9.5%
C/Combo	35,095	37,994	+2,899	+8.2%
D/Combo Plus & Zone 1	8,367	6,713	-1,654	-19.8%
E/Zone 2	8,864	7,282	-1,582	-17.8%
F/Zone 3	4,954	4,563	-391	-7.9%
G/Zone 4	3,709	3,584	-125	-3.3%
H/Zone 5	1,866	2,021	+155	+8.3%
J/Zone 6	2,776	2,804	+28	+1.0%
K/Zone 7	2,044	2,173	+129	+6.3%
L/Zone 8	199	199	0	0.0%
M/Zone 9	623	627	+4	+0.6%
P/Zone 11	9	13	+4	+44.4%
Total	139,166	144,072	+4,906	+3.5%

was a small loss in combined Combo Plus, Combo, Zone 1, and Zone 2 pass sales in October 1989 compared to combined C through E Pass sales in October 1988 of 337 passes, or 0.6 percent. This indicates that some riders may have also shifted to less expensive transit options either by driving to rapid transit and commuter rail stations with lower fares or to bus routes with lower fares.

Since there is overlap between rapid transit, surface transit, and commuter passes at the Combo to Zone 2 level, it is not possible to determine whether most of the shifting occurred on commuter rail, express buses or on the Braintree branch of the Red Line. However, based on declines in Zone 3 and Zone 4 commuter rail passes, at least some of this shifting occurred on commuter rail. Beyond Zone 4, pass sales either remained constant or increased. Based on the growth rates of Zone 5, 6, and 7 passes, it also appears that some shifting may have occurred from Zone 6 to Zone 5.

As a result of the fare increase and continuing growth, pass revenue increased by $1.0 million, or 20.3 percent, from $4.6 million in October 1988 to $5.6 million in October 1989. By comparison, without any ridership changes or shifting among pass types, the fare increase would have increased fare revenue by $0.9 million, or 18.4 percent. Also, before the fare increase, the average revenue per pass sold was $33.32; after the fare increase it was $38.74, an increase of 16.2 percent.

Since the fare increase, there has been a slight increase in the number of times which pass holders used their passes. In April 1989 before the fare increase, pass holders made an average of 52 trips per month on the rapid transit, surface Green Line and bus system while in October an average of 54 trips per month were made.[33] This increase could mean any of three things: an actual increase in usage per month, as the figures imply, or an increase in transfers between commuter rail and rapid transit, or between buses and rapid transit, or normal seasonal variations.

Changes in Average Fare

The average fare is a result of the combination of fare levels and ridership mix. Before the fare increase, the average fare paid by non-pass rapid transit, bus and surface Green Line riders was 49¢. After the fare increase, the average fare for non-pass users had increased to 58¢, up 18 percent.

Since different fares are charged on different modes, and the fare increase varied by mode, average fares and increases in average fares also varied by mode. As would be expected, the largest increase in average fare occurred on rapid transit, but increases also occurred on the surface Green Line and on the bus system. By mode, changes in average fare are as shown in Table 8-10.

IMPACTS OF THE PARKING FEE INCREASES

Rapid Transit, Surface Green Line and Bus Lots

Given the short period of time which had elapsed from the parking fee increases in October 1989 and the most recent available data from November, 1989, it is not possible to provide a truly representative estimate of the long-term parking-related ridership loss. However, through the end of October 1989, the $1 per day parking fee increase has resulted in approximately a 7.5

[33]Estimates based on the number of pass trips per day, as estimated in this report, divided by the number of passes sold and multiplied by the number of days in the month. Figures include commuter rail pass sales that are valid on rapid transit, the surface Green Line and buses.

Table 8-10
Changes in Average Fares by Mode for Non-Pass Riders[34]

	April 1989	October 1989	Change	%Change
Rapid Transit	53.1¢	65.7¢	+12.6¢	+24%
Surface Green Line	45.0¢	47.1¢	+2.1¢	+5%
Bus	39.8¢	43.0¢	+3.2¢	+8%
Combined	47.0¢	54.3¢	+7.4¢	+16%

Note: Average fare information was not collected for commuter rail service.

percent decrease in weekday lot usage. This represents a loss of approximately 1,220 cars per weekday, with the largest percentage losses occurred at Arlington Heights and along the surface Green Line (up to 54 percent). By line, parking lot utilization was down 19 percent on the Green Line, 12 percent on the Orange Line, five percent on the Red Line, and remained the same on the Blue Line.

Table 8-11 displays before and after parking data by lot. Daily usage for November 1989 and 1988 actually refer to the average daily usage for the last week of November (November 27 - December 1, 1989 and November 28 - December 2, 1988). Data for a longer period of time was not used because more recent 1989 data (after December 2, 1989) was not available when the report was prepared; earlier data (the first three weeks of November) was not used because it would include more of the immediate but temporary impacts of the parking fee increases. However, it should also be noted that the data used (the fourth week following the parking fee increase) also likely includes the impact of temporary shifts that immediate follow price increases.
These include riders that parked at MBTA lots before the parking fee increase but that then chose to experiment with alternative modes. Of these riders, many will return to the MBTA, but some will not. It has been presumed that some of the ridership loss would be "back-filled" by persons that would be willing to pay the higher costs if space were available. One month after the parking fee increase, this had not occurred, as some space remained available throughout the day at many lots.

[34]This refers to the average fare paid by riders that do not use passes (but does include free outbound ridership on the surface Green Line). Since most passes are valid on more than one mode, pass revenue is not allocated by mode.

Table 8-11
MBTA Weekday Parking Lot Usage: November 1989 Versus November 1988

	Parking Fee Before	Parking Fee After	No of Spaces	Nov 1988	Nov 1989	Change	Percent Change
Green Line							
Riverside	$1.25	$2.25	1,128	1,260	1,008	-252	-20.0%
Woodland	$1.00	$2.00	448	516	450	-66	-12.8%
Waban	$1.00	$2.00	54	53	41	-12	-22.6%
Eliot	$1.00	$2.00	55	54	45	-9	-16.7%
Chest. Hill[35]	$1.00	$2.00	70	68	46	-22	-32.4%
Lechmere	$1.50	$2.50	323	337	270	-67	-19.9%
Total			2,078	2,288	1,860	-428	-18.7%
Orange Line							
Oak Grove	$1.50	$2.50	768	860	799	-61	-7.1%
Malden Ctr	$1.50	$2.50	165	247	199	-48	-19.4%
Wellington	$1.50	$2.50	1,253	1,521	1,324	-197	-13.0%
Sullivan	$1.50	$2.50	217	293	263	-30	-10.2%
Total			2,403	2,921	2,585	-336	-11.5%
Red Line							
Alewife	$3.00	$4.00	2,209	2,594	2,419	-175	-6.7%
North Quincy	$1.00	$2.00	1,205	1,279	1,248	-31	-2.4%
Wollaston	$1.00	$2.00	522	605	607	2	0.3%
Quincy Center	$1.50	$2.50	872	653	638	-15	-2.3%
Quincy Adams	$1.50	$2.50	2,227	2,126	2,039	-87	-4.1%
Braintree	$1.50	$2.50	1,228	1,363	1,282	-81	-5.9%
Total			8,263	8,620	8,233	-387	-4.5%
Blue Line							
Wonderland[36]	$1.00	$2.00	1,045	1,357	1,291	-66	-4.9%
Beachmont	$1.00	$2.00	394	408	420	12	2.9%
Suffolk Dwns	$1.00	$2.00	110	103	118	15	14.6%
Orient Hghts	$1.00	$2.00	365	374	414	40	10.7%
Total			1,914	2,242	2,243	1	0.0%
Other							
Mattapan[37]	$1.00	$2.00	216	105	79	-26	-24.8%
Milton	$1.00	$2.00	41	36	32	-4	-11.1%
Arl Heights	$1.00	$2.00	194	80	41	-39	-48.8%
Total-All Stations			***15,109***	***16,292***	***15,073***	***-1,219***	***-7.5%***

[35]Bridge construction at this station has recently affected accessibility.
[36]Parking at Wonderland had been expanded since November 1988. To account for this, "before" figures are from October 1989.
[37]A nearby free city lot was closed in November 1988 for resurfacing, thus increasing usage at MBTA lot. "Before" figures are October 1989.

Based on the before and after figures by lot, there does not appear to have been a strong correlation between the drop in parking lot utilization and the parking charge (whether $2.00 or $2.50). In general, the larger declines occurred at smaller stations, and smaller declines occurred at larger stations. Exceptions were Riverside and Wellington, which are among the larger lots in the system and experienced declines in weekday usage of 20 percent and 13 percent respectively. Alewife, which has the highest parking fee of all MBTA lots ($4.00 per day versus a high of $2.50 at any other lot), experienced a 6.7 percent decline in usage, which was below average for all lots.

Although the number of cars parking at MBTA stations has declined, daily usage at most lots continues to exceed the number of spaces available. This

occurs for two reasons: (1) turnover of spaces throughout the day, and (2) at many stations, more cars are admitted into lots than there are designated spaces (with "extra" cars parking at the end of aisles, etc.). Therefore, while many stations appear to still exceed "capacity", there has been an actual decline in utilization. Further, many stations that previously had filled during the morning had space available throughout the day during the last week of November (see Table 8-12).

Ridership Impacts of the Parking Fee Increase

The decline in 1,220 cars per weekday parking at MBTA lots translates into a loss of approximately 2,020 trips per average day (2,680 weekdays, 1,110 weekends).[38] Nearly all of the decline occurred on rapid transit and the surface Green Line. Exceptions would be the decline at Riverside, which would be split between the surface Green Line and bus Route 300, and the losses at Arlington Heights, all of which would be from bus service.

At Riverside, most parkers utilize Route 300 or the surface Green Line. The most recent count data for those two services indicates that ridership on Route 300 was approximately 1,610 per weekday and to and from Riverside on the surface Green Line was approximately 3,140 per weekday, resulting in an approximate one-third/two-thirds split. Assuming that the loss of 242 parkers was split one-third/two-thirds between Route 300 and the Green Line, then the ridership loss would be 175 trips per weekday on the bus system, and 355 trips per day on the surface Green Line. For an average day (including weekends), the losses would be 130 trips per day on the bus system and 265 per day on the surface Green Line.

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[38]Based on an average auto occupancy rate of 1.1 persons (from the Red Line Extension to Alewife: Before/After Study, CTPS, December 1987) and two one-way trips per person.

Table 8-12
Parking Lot Status After the Parking Fee Increase: 11/27/89 - 12/1/89

	Before Increase	After Parking Fee Increase				
		Monday 11/27	Tuesday 11/28	Weds 11/29	Thurs 11/30	Friday 12/1
Green Line						
Riverside	Full					
Woodland	Full		Full	Full		
Waban	Full					
Eliot	Full					
Chestnut Hill	Full	Full	Full		Full	
Lechmere	Full					
Orange Line						
Oak Grove	Full					
Malden Center	Full					
Wellington	Full					
Sullivan	Full	Full	Full	Full	Full	Full
Red Line						
Alewife						
North Quincy	Full					
Wollaston	Full	Full	Full	Full	Full	
Quincy Center	Full					
Quincy Adams	Full			Full	Full	
Braintree	Full	Full	Full	Full	Full	
Blue Line						
Wonderland	Full	Full	Full	Full	Full	
Beachmont	Full					
Suffolk Downs	Full		Full	Full		
Orient Heights	Full		Full			
Other						
Mattapan						
Milton						
Arlington Hghts						

Note: Full indicates that the lot was full at some time during the day. "Blank" indicates that there was space available throughout the day.

In total, for all stations, the parking fee increases resulted in the following losses in average daily ridership:

Rapid Transit: 1,200 per day
Surface Green Line: 630 per day
Buses: 190 per day

Compared to April 1989 ridership, these figures represent a loss of 0.3 percent on rapid transit, 1.0 percent on the Green Line, and less than 0.1 percent on bus service. These percentage decreases are small because the proportion of MBTA riders affected by the parking fee increases was relatively small. The parking fee increases were applied to 15,109 spaces, which, before the parking fee increase, accounted for 29,300 of a total of 722,100 daily trips systemwide, or only four percent of total ridership.

Systemwide, the parking fee increases have increased the average revenue per car from $1.56 to $2.56, and revenue from $19,115 to $28,950 per day.[39] This 51 percent increase in parking revenue will generate an additional $3.6 million, increasing parking revenue from approximately $7.0 million per year to $10.6 million.

Commuter Rail

Before implementation of parking fees at commuter rail stations, data on daily lot utilization was not collected on a regular basis. Data was collected as necessary for planning purposes, but comparable data is not available for all stations or during the same timespan. Therefore, without this before data, it was not possible to reliably determine the ridership impacts of the parking fees on the commuter rail system. However, daily utilization data is now being collected by the parking contractors at all stations with fees so that data will be available in the future.

GEOGRAPHIC DISTRIBUTION OF RIDERSHIP CHANGES

The geographic distribution of ridership change caused by the fare increase reflects the variation in fare changes over the various services which the MBTA provides. Because rapid transit, commuter rail and express bus fares were raised while local bus and some surface Green Line fares were held constant, areas served by the former modes experienced ridership losses, while those served by the latter had generally smaller losses, and in many cases increases in ridership. Figure 8-1 displays the MBTA region (contained

[39]As with ridership figures, these "per day" figures are different from "per weekday" figures, and are a weighted average of weekday and weekend revenue.

Figure 8 - 1
Estimated Net Change in Ridership
Due to the 1989 Fare Increase
by CTPS Traffic Analysis Zone

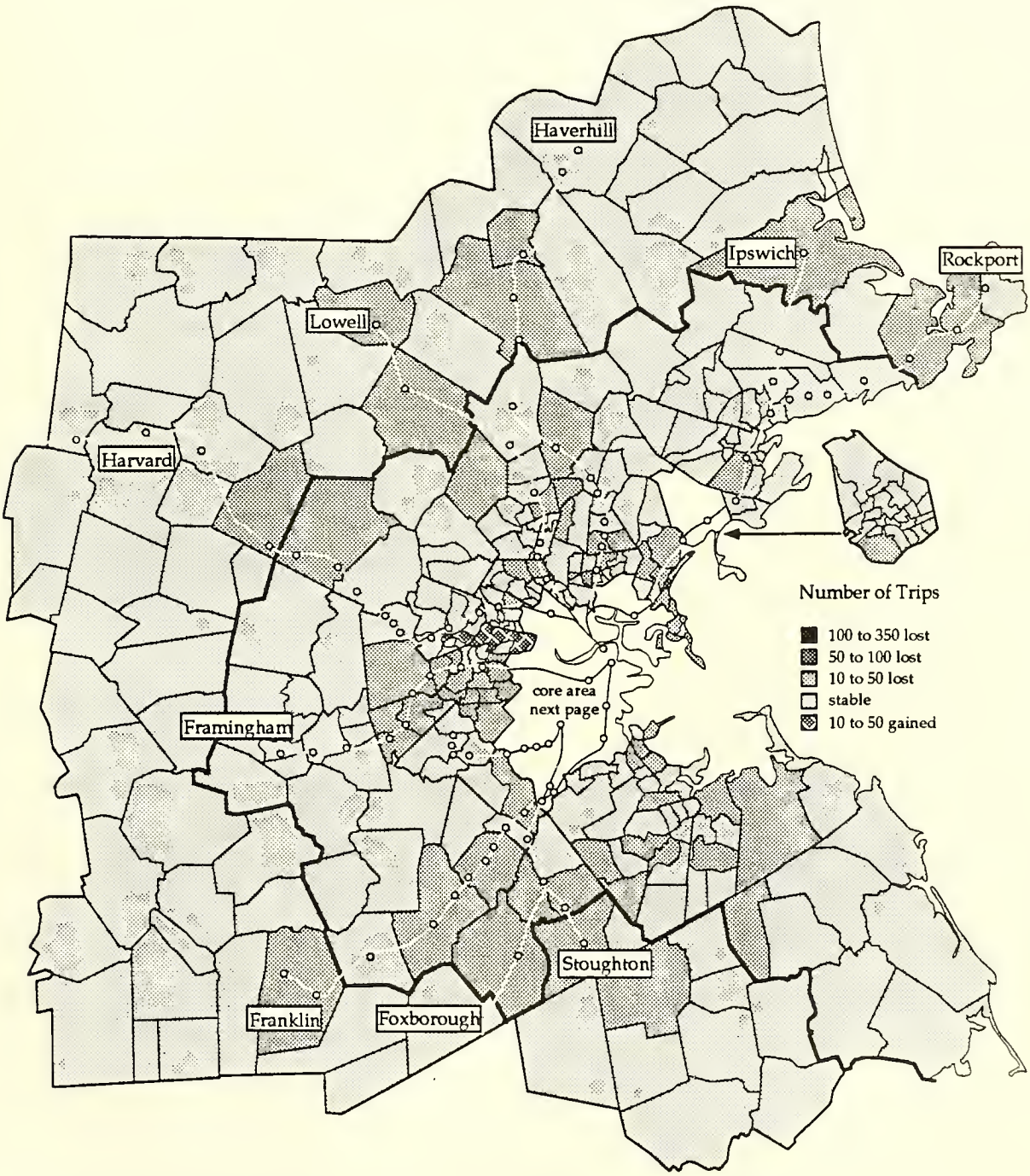
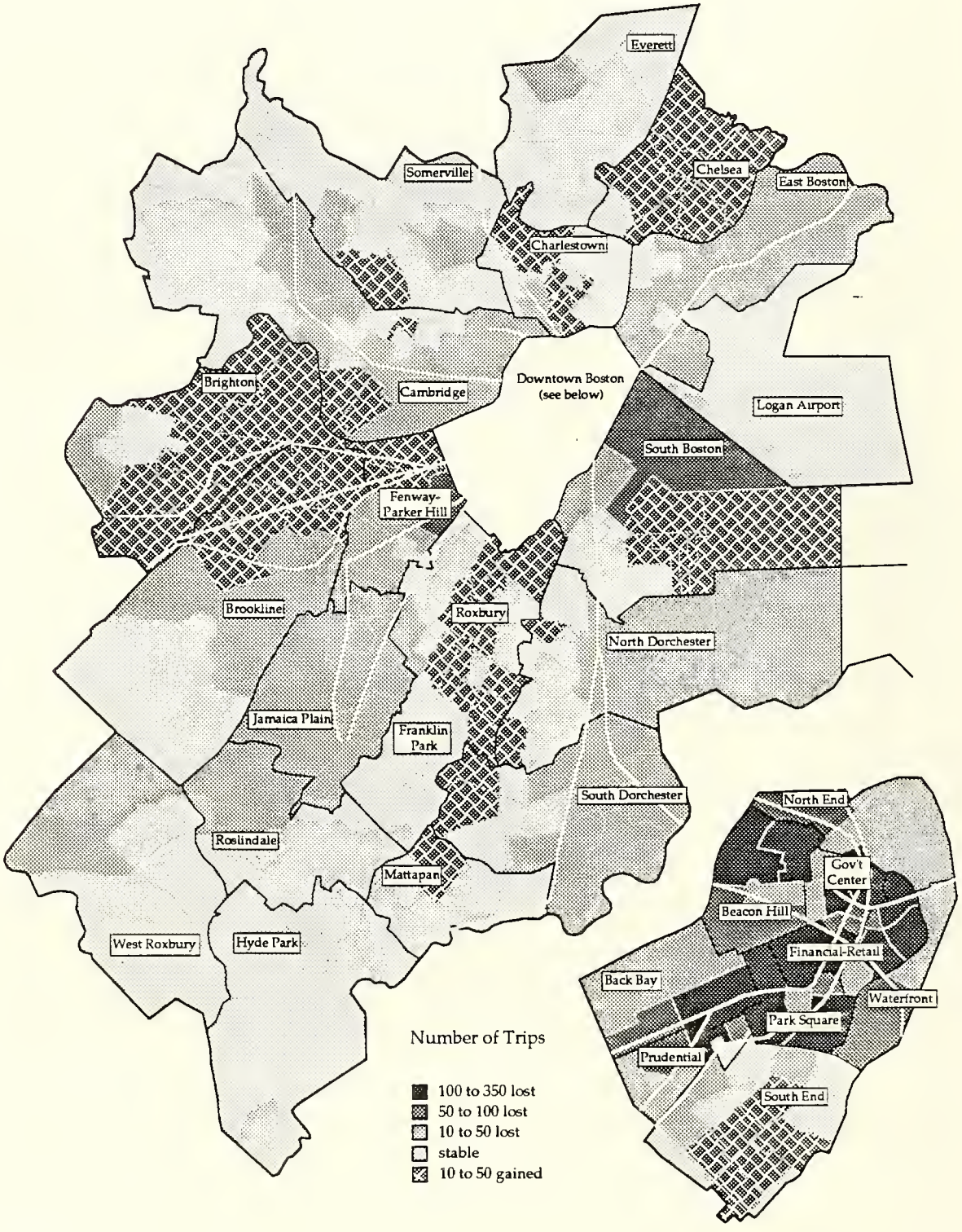


Figure 8 - 2
Estimated Net Change in Ridership
Due to the 1989 Fare Increase
by CTPS Traffic Analysis Zone



within the black outline) and estimated ridership changes by CTPS Analysis zones.[40] Small to moderate ridership losses occurred along commuter rail lines while most of the rest of the region remained fairly stable. In the core area, displayed in Figure 8-2, the differences between rapid transit and bus served areas are more pronounced. The traffic zones lying near the four rapid transit lines exhibit small to moderate losses with the heaviest losses occurring in the downtown area. Zones where local bus is the primary transit mode, on the other hand showed increases in ridership, most notably the South End, Roxbury, Chelsea, Charlestown and South Boston. In addition, portions of the surface Green lines near Cleveland Circle in Brookline and Brighton showed ridership gains.

There is a clear indication, then that there is some elasticity in the demand for transit services: in the zones contiguous to transit modes which had fare increases, ridership declined and in those near to fare-constant modes, ridership increased or stayed the same.

SUMMARY - RIDERSHIP AND REVENUE IMPACTS

Overall, seasonally adjusted ridership declined slightly as a result of the fare increase and parking fee increases. As shown in Table 8-13, systemwide, there was a 0.4 to 1.9 percent systemwide ridership decline attributable to the fare increase, and a 0.3 percent ridership decline attributable to the rapid transit, surface Green Line and bus parking fee increases. The total loss in existing ridership was 5,070 to 15,970 trips per day.

As expected, the largest decline was on rapid transit, where ridership declined 3.6 to 6.8 percent, or 12,730 to 24,650 trips per day. However, many of these riders may have shifted to surface Green Line service or to bus service. On these modes, ridership increased by a total of 7,170 to 9,020 trips per day, or 2.1 to 2.7 percent. For the basic system of rapid transit, the surface Green Line and bus service, ridership declined by 0.5 to 2.2 percent, or by 3,540 to 15,630 trips per day.

On commuter rail, seasonally adjusted ridership increased by 1.1 percent, or by 490 trips per day, in spite of the fare increase. However, this increase is much lower than had been previously occurring, and when lost growth is considered, there would be a loss of approximately 0.7 percent, or 340 trips per day.

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[40]Estimates derived from CTPS's Regional Transit Model, which estimates changes by subregion based upon the total ridership change by mode, the change in fare by mode and area, and the mode or modes that each zone is served by.

Table 8-13
Summary of Ridership Before and After the Fare and Parking Fee Increases
(Average Daily Ridership)

	Rapid Transit	Surface Green Line	Bus	Subtotal RT/GL & Bus	Commuter Rail	Total
ACTUAL RIDERSHIP						
Before	**354,240**	**67,100**	**283,320**	**704,660**	**45,650**	**750,310**
After	**347,240**	**73,120**	**294,550**	**714,910**	**46,170**	**761,080**
Change	-7,000	+6,020	+11,230	+10,250	+520	+10,770
Percent Change	-2.0%	+9.0%	+4.0%	+1.5%	+1.1%	+1.4%
SEASONALLY ADJUSTED RIDERSHIP						
Before	**349,350**	**65,400**	**276,140**	**690,890**	**46,350**	**737,240**
After Fare Increase	**337,820**	**69,500**	**280,030**	**687,350**	**46,840**	**734,190**
Change Since Fare Increase	-11,530	+4,100	+3,890	-3,540	+490	-3,050
Percent Change	-3.3%	+6.3%	+1.4%	-0.5%	+1.1%	-0.4%
After Parking Fee Increase	**336,620**	**68,870**	**279,840**	**685,330**	**46,840**	**732,170**
Change Since Parking Fee Increase	-1,200	-630	-190	-2,020	NA	-2,020
Percent Change	-0.3%	-1.0%	-0.1%	-0.3%	NA	-0.3%
Total Change in Existing Ridership	-12,730	+3,470	+3,700	-5,560	+490	-5,070
Percent Change	-3.6%	+5.3%	+1.3%	-0.8%	+1.1%	-0.7%
Projected Ridership w/o Fare and and Parking Fee Increases	**361,270**	**65,050**	**274,640**	**700,960**	**47,415**	**748,375**
Difference from Observed:						
• After Fare Increase	-23,450	+4,450	+5,390	-13,610	-575	-14,185
Percent Change	-6.5%	+6.8%	+2.0%	-1.9%	-1.2%	-1.9%
• After Parking Fee Increases	-24,650	+3,820	+5,200	-15,630	-575	-16,205
Percent Change	-6.8%	5.9%	1.9%	-2.2%	-1.2%	-2.2%

Note: "Before" and "After" rapid transit, surface Green Line, and bus ridership refers to April 1989 and the end of October 1989. "Before" and "After" commuter rail ridership refers to February and October 1989.

The decline in rapid transit ridership and the increase in surface ridership represents a reversal of the ridership trends that had been occurring since 1983, where rapid transit ridership had been increasing but surface ridership had been declining. (However, now that the fare increased has happened and the shifts between modes have occurred, prior trends may resume.)

With the fare and parking fee increases, fare revenue from all modes has increased. Rapid transit, cash and token revenue has increased by 18.5 percent, surface Green Line revenue has increased by 19.3 percent, and bus revenue has increased by eight percent. Combined revenue from all three modes has increased by 15.1 percent.

At the same time, both pass revenue and sales have increased. Compared to the prior year, October pass sales have increased by 3.5 percent, and revenue has increased by 20.3 percent. Due to the fare increase, revenue per pass sold has increased by 16 percent, from $33.32 to $38.74 (including commuter rail pass sales).

The above ridership, pass sales and revenue figures indicate that the judgement that modest fare and parking fee increases would not significantly affect transit ridership or stimulate significant increases in automobile usage was correct. The 0.7 percent loss of existing riders was extremely small, and lower than the expected ridership loss of 1.2 to 3.0 percent. The loss due to deferred growth was also relatively small, at 1.4 percent.

Fare and parking fee increases produce shift in travel patterns as people seek to avoid the added cost by changing their trip behavior. In recognizing that different people will react to an increase in different ways, and by providing low cost transit options for those most sensitive to the fare increase, the effect on total ridership can be mitigated. This appears to have been accomplished in a number of areas:

1) Commuter Rail The commuter rail fare increase, in response to public comment, was scaled so as to increase fares on long trips proportionally less than on short trips, recognizing that the specific dollar increases would still be greater for the longer trips. The fare increase was also mitigated by providing for deeper discounts for pass users than originally proposed. The quality of service on commuter rail has increased significantly because of added investment in new equipment. Also, increases in downtown Boston parking costs and traffic congestion continue to improve commuter rail's competitiveness relative to automobile options. This has resulted in steady growth in commuter rail ridership, and in spite of the fare increase, actual ridership was up by 1.1 percent.

2) Rapid Transit, Surface Green Line and Express Bus The quality of service has steadily improved as a result of the major capital investment in both fixed plant and rolling stock. This has been reflected in ridership increases averaging over three percent per year on the three modes. The fare increase was mitigated by increasing discounts on prepaid passes and by providing the opportunity to purchase eleven tokens for the price of ten. Actual rapid transit ridership went down by 3.3 percent as a result of the fare increase. This was a modest but significant change in light of prior experience of steady ridership growth, but the increased utilization of the pass program indicates that the revised pass program was a useful mitigation strategy.

The cash fare increase was also mitigated by leaving local bus and B, C, and E branch surface Green Line fares constant. This was done for two reasons. First, many transit trips actually involve a rapid transit plus bus trip, so that leaving bus fares constant reduced the impact on riders that use both services. This is analogous to the less than proportional increases for the longest commuter rail trips in recognition of the large increase in absolute costs. It was also in recognition that a transfer between modes inherently results in a lower quality trip than a one-ride rapid transit trip. Secondly, leaving bus and surface Green Line fares constant permitted riders that were the most sensitive to cost to avoid the fare increase by using bus routes parallel to rapid transit. This appears to have occurred, in that surface ridership, which had been stagnant or slightly declining over the past five years, increased by 2.3 percent, offsetting much of the rapid transit loss.

3) Parking Fee Increase Parking fees impact only four percent of MBTA rapid transit, surface Green Line and bus riders, and most parking lots were at capacity. For this reason, it was believed that increases in parking charges would tend to have minimal impact on ridership in that any loss of ridership due to increased parking charges would be offset by other latent parking demand from potential riders who had been frustrated by the shortage of parking.

Further, to the degree that customers would seek to avoid the rapid transit parking fee increases by walking to the station, ridesharing, or using feeder buses, the result would be more efficient use of a scare resource (parking). The marginal cost of adding parking to deal with the capacity shortage through construction of parking garages is up to $20,000 per space, a daily cost of approximately seven dollars. Therefore, to the extent that an adjustment in parking fees encourages riders to access MBTA service by other means, it is less damaging than other increases. The changes in parking lot utilization following the parking fee increases have initially indicated a greater loss than expected, which needs to be carefully monitored through additional surveys.

SOCIOECONOMIC IMPACTS OF THE FARE INCREASE

Transit service is generally considered to provide a number of socioeconomic benefits. It provides user benefits in the form of increased accessibility to employment, shopping, and cultural opportunities and as an alternative to automobile use, and non-user benefits such as decreased traffic congestion, increased land values, and increased labor markets. This section focuses on the socioeconomic impacts of the subsidies provided to MBTA riders.

These riders can generally be considered to fall into one of two categories: discretionary riders or transit dependent riders.

Discretionary Riders Discretionary riders are those that use transit rather than other travel means by choice – either because it is more convenient or the cost is lower. Typically, discretionary riders have access to an automobile and, therefore, more of a choice of whether or not to use public transportation. These riders primarily use the MBTA for commuting trips, and make many fewer non-work trips than non-discretionary riders.

Reduced travel time and costs are major reasons for the diversion of discretionary riders to mass transit. The most significant time savings are realized on rail facilities having exclusive rights-of-way. Therefore, rapid transit and commuter rail have higher numbers of discretionary riders than local bus service. Cost savings are realized through reduced automobile operation and maintenance expenses, lower parking fees, and reduced insurance premiums.

Transit Dependent Riders Transit dependents are those that have no other alternative than to use transit, usually due to low income or physical disability. In this area, as in other urban areas, transit dependent riders generally reside in urban core areas, have lower incomes, and do not have an automobile available for their trip. In addition, significant populations of the elderly and the those with disabilities, regardless of income, are unable to operate an automobile. Based on these characteristics, the MBTA uses five primary indicators of transit dependency: household income, automobile availability, age, whether or not the rider has a drivers license and/or has a disability.

All of these indicators are inexact, but used together, are effective in identifying "disadvantaged" areas or groups. For example, many low income households have access to automobiles and many autoless riders, especially in Boston, do not have automobiles by choice. However, areas with high numbers of autoless and low income households do have high

numbers of transit dependent residents. In addition, although many senior citizens have higher than average incomes and an automobile available, higher proportions are also unable to drive. Therefore, areas with high percentage of elderly residents usually also have relatively high numbers of transit dependent residents.

For these transit dependent riders, transit service is often the only means to access education, employment, and shopping opportunities. As a result, to promote social and economic equity for the region's transit dependent population, the MBTA provides extra service and/or operates lightly utilized bus services in areas with high percentages of transit dependent riders.

Because the reasons for using the MBTA are different for discretionary and transit dependent riders, the fare increase will have different impacts on the two groups. Discretionary riders use the MBTA mainly for work trips. Traditionally, fare increases cause a shift away from transit to other modes to the extent that transit trips become more expensive than the actual or perceived cost of other alternatives. For transit dependents, most riders will have no choice but to pay the increased costs for work trips in the short-term, but may begin to combine other types of trips to reduce the total number of transit trips made. The immediate impact on those riders is less income available for other needs. However, in the long-term, as with discretionary riders, if transit becomes more expensive than other modes, there can also be a shift away from transit for work trips. However, as further discussed below, because the magnitude to this fare increase was relatively small, it is estimated that there has been little shift away from transit among either discretionary or transit dependent riders.

Ridership Impacts by Fare Type

Full Fare

Although fares were increased the most for full fare riders, this ridership type showed the highest growth, and has grown as a percentage of total ridership. Before the fare increase in April 1989, 293,810 daily riders, representing 42.5 percent of all trips, paid adult cash fares; after the fare increase in October 1989, 277,310 daily trips, representing 40.3 percent of all trips, were made at adult cash fares. This is a decrease of 16,500 daily trips, or 5.6 percent.

Approximately half of the decline in adult cash ridership was made up by gains in adult pass ridership. Before the fare increase, 237,870 daily trips (34.4 percent of all riders) were made using passes. After the fare increase, this had increased by 8,280 daily trips, or 3.5 percent, to 246,150 daily trips (35.8 percent). By mode, and as discussed in more detail earlier in this chapter and previously shown in Table 8-7, adult cash ridership declined on rapid transit

and bus service, while pass ridership increased. On the surface Green Line, adult cash ridership increased and adult pass ridership declined.

Elderly and Persons with Disabilities

Ridership by the elderly and those with disabilities was observed to have increased by 2,790 trips per day from 71,810 daily trips to 74,660 daily trips. This represents an increase of 3.9 percent. from 10.3 percent of total ridership in the Spring of 1989 to 9.0 percent in the Fall of 1989. All of the increase was observed on the bus system; on rapid transit and the surface Green Line, declines were observed. However, since nearly all rapid transit and most surface Green Line fares remained unchanged, it is unlikely that the declines were attributable to the fare increase. More likely, they are seasonal variations and/or measurement error.

Child/Student Ridership

Overall student ridership remained relatively unchanged, showing an increase of 0.2 percent from 46,190 daily trips to 46,270 daily trips.[41] By mode, there was an decline of 150 daily trips on rapid transit, a decline of 210 trips on the surface Green Line, and a gain of 422 trips on bus service.

As with changes in ridership by the elderly and those with disabilities, observed changes in student ridership are believed to be more the result of seasonal variations in ridership patterns. Students should have been affected by the fare increase to a lesser extent than adult riders, since a large majority of student/child trips (approximately two-thirds) are made on bus service. Also, as previously mentioned, many of these trips are school trips, which are not discretionary trips, and many are pass trips which are either subsidized or paid for by schools.

Fare Burden

Although transit service is highly subsidized, transit fares can nonetheless can provide a hardship to certain groups. As with nearly any type of cost increase, fare increases have a greater impact on the low-income riders than on high income riders. For example, the annual cost of rapid transit service (based on monthly pass purchases) increased from $264 to $324. For a person making $10,000 per year, transit now costs 3.2 percent of their income, compared to 2.6 percent before the fare increase. For a person making $40,000, rapid transit service now costs 0.8 percent of their annual income, compared to 0.7 percent before the fare increase. For the average eastern Massachusetts household making $31,000 per year, the cost of rapid transit service for one

[41]These figures do not include ridership on "S" trips, which consists of special school service and is not considered part of regular service.

adult now represents 1.0 percent of household income, up from 0.9 percent before the fare increase. While the cost of rapid transit service remains relatively inexpensive since the fare increase, the cost of commuter rail service is more expensive. Before the fare increase, the annual pass cost of commuter rail ranged from $264 (Zone 1A) to $1,248 (Zone 11). After the fare increase, these annual costs have increased to $324 to $1,512. For a person making $10,000, commuter rail fares before the fare increase would represent 2.6 to 12.5 percent of their annual gross income. After the fare increase, commuter rail cost increased to 3.2 to 15.1 percent. For someone making $40,000 per year, fares now represent 0.8 to 3.8 percent of gross annual income, up from 0.7 to 3.1 percent before the fare increase. For the average Massachusetts household making $31,000 per year, commuter rail fares now represent 1.0 to 4.9 percent of gross annual income, up from 0.9 to 4.0 percent before the fare increase.

Household income distribution is provided in Figures 8-3 and 8-4 which identify areas of the region whose residents, on average, are particularly at risk for paying a large transit fare burden of fare increases. Figure 8-3 displays the portion of Eastern Massachusetts which includes the 78 cities and towns of the MBTA district (circumscribed by the heavy black line). In this area, relatively few zones exhibit low household income levels (below the $27,000 for a family of three). Notable exceptions are portions of Quincy, Revere, Lynn, Waltham Salem, Peabody and Malden. The urban neighborhoods shown in Figure 8-4, exhibit a higher proportion of zones with average income of below $27,000 per household. It should be noted that the $27,000 threshold, while well above the poverty level, is used as a definition for certain Massachusetts programs as a cut-off for aid and corresponds to the $15,000 (1979 dollars) threshold which was used for analysis in the 1981 Fare Increase Environmental Impact Report.

To reduce the fare burden for low income and other transit dependent groups, the MBTA provides lower fares for certain services and and to certain groups. These reduced fares take the following forms:

- 50¢ local bus fare.
- 10¢ base rapid transit and bus fare for senior citizens and persons with disabilities.
- 50% discount for senior citizens and persons with disabilities on Zone 2 and 3 rapid transit service, express and zoned bus service and commuter rail.
- 50% discount for children 5-11 and students.

These discounts are designed to reduce the cost of transit for low income transit dependents. However, they are provided indirectly based on the transit dependency indicators described previously (low income, automobile availability, age, and whether or not the rider has a drivers license and/or a

Figure 8 - 3
1979 Household Income
in 1989 Dollars
by CTPS Traffic Analysis Zone

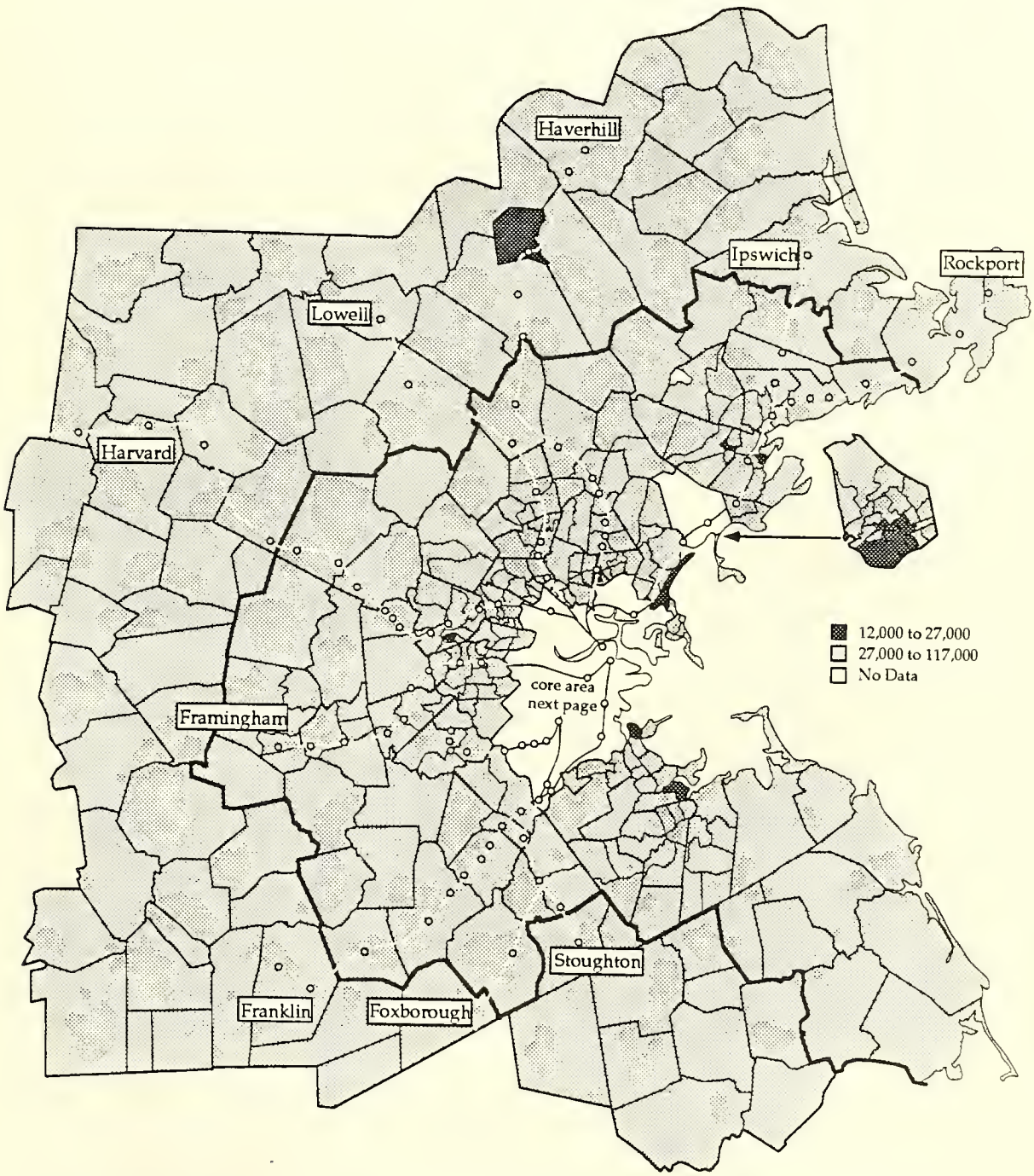
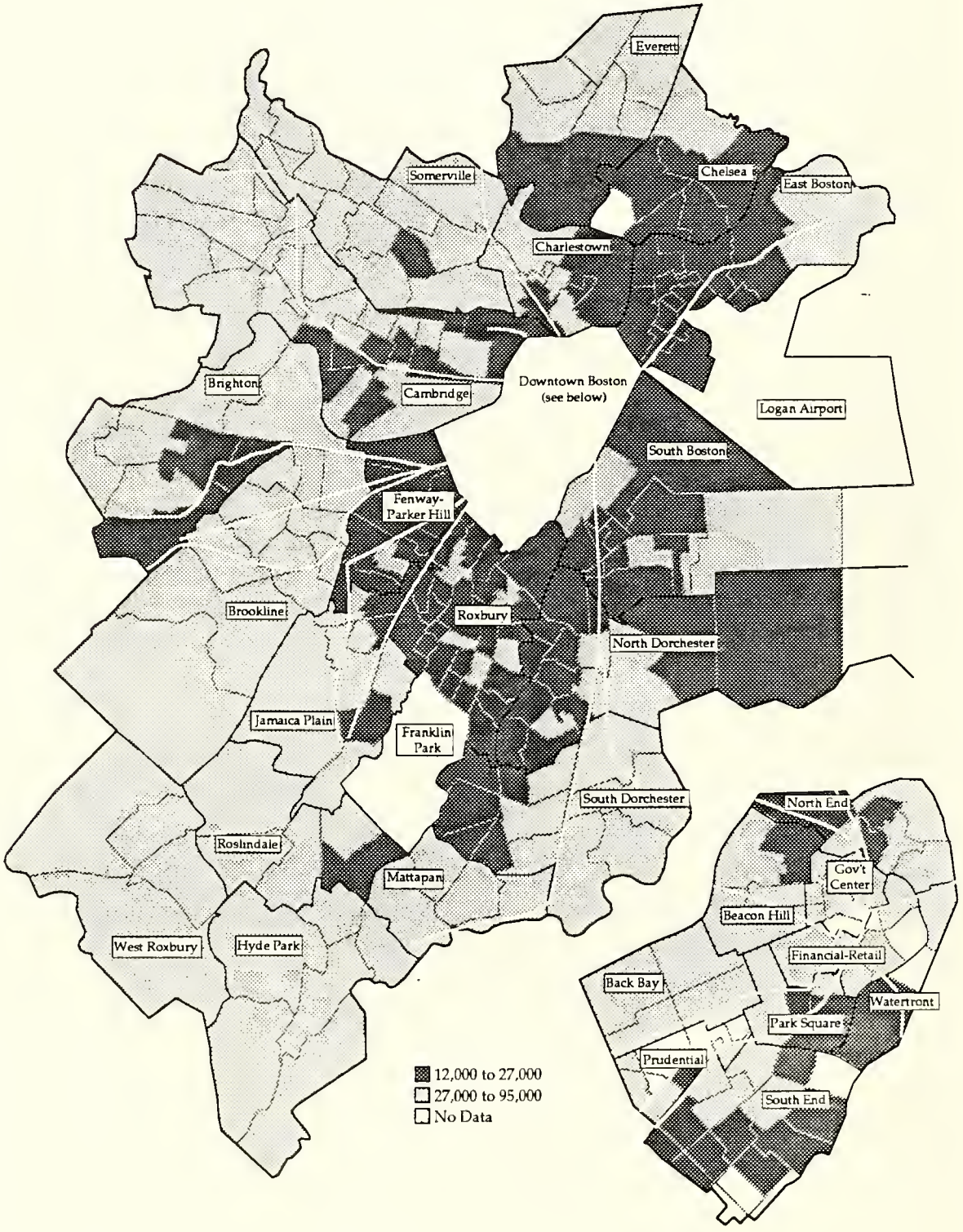


Figure 8 - 4
1979 Household Income
in 1989 Dollars
by CTPS Traffic Analysis Zone



disability) because there is no generally accepted substitute criteria that is more direct or practical to administer. The type of discounts provided by the MBTA are fairly standard within the United States and Canada.

50¢ Local Bus Fare

The MBTA has a two-tiered fare structure for its basic bus and rapid transit service, charging 50¢ for bus service and 75¢ for rapid transit service. The lower bus fare is largely based on two factors: (1) bus service is less expensive to operate, and (2) bus trips are shorter than rapid transit trips. However, an additional consideration is based the results of the 1978 MBTA system-wide passenger survey which showed that bus riders, on average, were from lower income households than rapid transit riders (see Table 8-14) The 1978 survey also showed that while rapid transit riders were from households with higher than average incomes for the greater Boston area, bus riders were from households with lower than average incomes. Based on this information, bus fares have also been set lower than rapid transit fares to provide a form of low-income subsidy.

Table 8-14
1978 Passenger Survey
Socioeconomic Characteristics of Bus and Rapid Transit Riders

	Household Income < $15,000/yr	No Auto in House-hold	No Drivers License	Elderly & Disabled
Bus Riders	59%	34%	37%	8%
Rapid Transit Riders	48%	27%	NA	4%

Note: The 1978 survey classified riders by the service on which they were surveyed, and both categories include riders that have transferred from the other mode (23 - 25 percent in each category).

A full analysis of the differences between bus and rapid transit riders has not been conducted since the 1978 survey, but data collected as part of the corridor bus studies continues to indicate that bus service serves a more transit dependent market. This data does not allow a direct comparison of riders who only use buses or rapid transit, but does allow for a comparison of riders who only use buses and those that transfer between buses and the rapid transit system or express buses. In all corridors for which CTPS had data, riders who only used bus service had lower household incomes, more did not have an automobile available and/or did not have a drivers license, and were elderly and/or persons with disabilities (see Table 8-15).

Table 8-15
Corridor Bus Study Passenger Survey Results
Socioeconomic Characteristics

Corridor	Household Income < $20,000/yr	No Auto Available	No Drivers License	Elderly & Disabled
South Shore (1982)				
Riders That Only Use Local Buses	54%	84%	59%	10%
Combined Bus/Rapid Transit Riders	45%	67%	29%	9%
Central North Corridor (1984)				
Riders That Only Use Local Buses	64%	78%	37%	6%
Combined Bus/Rapid Transit Riders	61%	77%	33%	7%
West Corridor (1986)				
Riders That Only Use Local Buses	63%	48%	55%	19%
Combined Local/Express Bus Riders	33%	33%	20%	7%
South Corridor (1986)				
Riders That Only Use Local Buses	59%	84%	55%	18%
Combined Bus/Rapid Transit Riders	39%	61%	30%	13%

As with most forms of reduced fares, the lower bus fare is very broad-based – because a large percentage of riders in a certain group are transit dependent, all riders in that group are provided discounts. As stated above, this is done because there is no generally accepted method of providing the discount to transit dependent riders more directly. However, unlike most forms of reduced fares, it is provided to a very large number of riders. As shown in Table 8-16, the lower bus fares are provided to up to 29 percent of all MBTA riders. By comparison, the discount for the elderly and those with disabilities is provided to 11 percent, and child and student discounts to seven percent.

Further, while low income riders do appear to utilize bus service more than other services, they nonetheless comprise only 25 percent of all bus riders (based on 1978 survey results). Therefore, over twice as many riders that are not considered low income are also provided a "low income" discount. The value of the discount provided to bus riders, assuming that the fare would otherwise be the same as rapid transit, is $10.7 million per year, of which approximately $8.0 million (75 percent) is provided to riders that are not low income.

Discounts for Senior Citizens and Persons with Disabilities

Prior to the August 1981, the MBTA charged elderly riders one-half fare all day and those with disabilities full fare during peak periods and 50 percent of the full fare during off-peak periods. These fares were in accordance with

Table 8-16
Fall 1989 Average Daily Ridership Breakdown by Fare Type

	Number	Percent
Bus		
Adult Cash	97,380	14.2%
Pass	102,540	14.9%
Subtotal	***199,920***	***29.1%***
Rapid Transit & Surface Green Line		
Adult Cash	179,930	26.2%
Pass	143,610	20.9%
Subtotal	***323,540***	***47.1%***
All Modes		
Elderly & Disabled	74,660	10.9%
Child/Student Cash & Pass	46,270	6.7%
Free[42]	42,950	6.2%
Total	**687,340**	**100.0%**

UMTA conditions to receive UMTA Section 9 operating assistance. Then in December 1982, the state legislature reduced elderly fares further to 10¢ all day on all local bus, rapid transit, and Green Line service, and to half-fare on express bus, zoned bus, and commuter rail during peak periods as well as off-peak periods. Fares for persons with disabilities were also reduced to the same level as elderly fares during off-peak periods, but remained at full fare during peak periods. Three and one-half years later, in 1986, the MBTA reduced peak period fares for persons with disabilities to the same level as for elderly riders.

The 1989 fare increase did not raise fares for elderly riders or those with disabilities; therefore it will have no direct impact on these riders. However, because the cost of these fares was not increased, discount levels have increased relative to other fares. Before the fare increase, the discount for elderly riders and persons with disabilities was 40¢ for bus service and 50¢ for rapid transit service. With the fare increase, the discount for rapid transit trips has increased to 65¢.

Before the fare increase, the value of the discounts provided to the elderly and persons with disabilities was in excess of $12.1 million per year: at least $6.4 million for rapid transit and $5.7 million for bus service and surface

[42]Includes free trips on outbound surface Green Line service, the Mattapan High Speed Line, by MBTA employees, and fare evaders.

Green Line service.[43] As of October 1989, the value of the discount has increased to over $13.8 million per year: at least $8.1 million for rapid transit, $4.8 million for bus service, and $0.7 million for the surface Green Line.[44] As mentioned above, of the discounts provided, only a 50 percent off-peak discount is required by federal law.

The exact value of each component of the existing elderly and persons with disabilities discount program cannot be accurately determined because ridership data for these groups is not available by time of day. However, based on the 1978 passenger surveys, the 1985 Green Line counts, and the 1989 rapid transit counts, approximately 53 percent of all bus ridership, and 48 percent of all surface Green Line ridership and rapid transit ridership occurs during the off-peak. However, there are differences between ridership habits of the elderly and persons with disabilities, and other riders – elderly riders and those with disabilities make significantly fewer work trips and more shopping trips than other riders. As a result, this group makes fewer trips during peak periods and more during off-peak periods. Assuming that 75 percent of all trips made by elderly and persons with disabilities are during the off-peak periods, then the annual cost of the various discounts would be as shown in Table 8-17.

Total discounts for the elderly and persons with discounts provided by the MBTA beyond those required by the federal government totaled approximately $6.6 million before the fare increase. Since the fare increase, the value of the discounts has increased to $7.6 million. If the MBTA reduced discounts for the elderly and persons with disabilities from their current levels to 50% for all trips during all periods, fare revenue would increase by up to $6.6 million per year. (This would increase all base fares for the elderly persons with disabilities from 10¢ to 25¢ for bus and 35¢ for rapid transit.)

As with the lower bus fare, the discounts for senior citizens and persons with disabilities are designed to provide a more affordable fare for lower income riders. These discounts are also very broad-based in that they are provided to all riders over 65 and all those with certain disabilities without respect to income. However, as shown in Table 8-18, bus corridor studies conducted by CTPS indicate that elderly and handicapped bus riders are more transit dependent and lower income than other riders.

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[43]Estimates are based on discounts from base fare before and after the fare increase. They do no take into account discounts for zoned trips (Red Line to Quincy and Braintree, the Riverside Line and zoned buses), which are higher.
[44]As discussed above, it appears that some elderly and disabled riders were miscounted as full fare riders in the after counts. These subsidy figures are also understated to the extent that that occurred.

Table 8-17
Annual Cost of Elderly and Disabled Subsidies on Bus and Rapid Transit Service

	Before Fare Increase	After Fare Increase
Peak Periods	$3.0 million	$3.4 million
Off-Peak		
50 % Federally Mandated Discount	$5.5 million	$6.1 million
Additional MBTA Discounts	$3.6 million	$4.2 million
Subtotal	$9.1 million	$10.3 million
Total	***$12.1 million***	***$13.7 million***

Note: Estimates assume 75% of all travel by the elderly and persons with disabilities occurs during off-peak hours. Also, all estimates are based on the discounts from base fare only (since detailed information on zoned trips is not available).

Table 8-18
Corridor Bus Study Passenger Survey Results
Socioeconomic Characteristics of Elderly and Disabled Riders

	Household Income < $20,000/yr	No Auto Available	No Drivers License
South Shore Corridor (1982)	93%	77%	60%
Central North Corridor (1984)	83%	86%	57%
West Corridor (1986)	65%	NA	51%
South Corridor (1986)	75%	83%	62%

Student Discounts

Child and student fares are set based on Massachusetts General Law, Chapter 161A, Section 5e, which states that children between 5 and 11 pay half fare at all times, and children less than 5 ride free. Students aged 12 through 18 (through high school) pay half fare for school or school-related trips upon showing a valid student badge. With the fare increase, base fares for child/student rapid transit trips has increased from 30¢ to 35¢.
Before the fare increase, the cost of child/student discounts was

approximately $4.5 million per year. In October 1989, the annual value of the discounts was $4.9 million. There is no accurate way of determining the extent of travel by children under 5 years of age, so the level of discount for this group alone cannot be estimated.

Subsidy Costs of MBTA Service

Subsidy Costs for Bus and Rapid Transit Service

In 1983, the first full year after fares were adjusted in 1981 and 1982, the MBTA's cost per passenger trip for bus and rapid transit service was $1.28, and the average revenue generated per passenger was 47¢ (see Table 8-19).[45] This required an average subsidy per passenger of 81¢. For FY 1989, the MBTA's cost per passenger trip for bus and rapid transit service had increased to $1.65, while the average revenue per passenger had remained essentially constant, at 48¢[46], increasing the average subsidy per passenger to $1.17. For FY 1990, with the fare and parking fee increases, the required subsidy per passenger is expected to remain at $1.17.

When measured in constant 1983 dollars, the MBTA's cost per bus and rapid transit passenger has decreased, but the value of fares collected has decreased to a greater extent, thus increasing the subsidy per passenger. Between 1983 and 1989, the MBTA's cost per bus and rapid transit rider decreased by one cent from $1.28 to $1.27. However, since fares had not been increased, the value of the revenue collected decreased from 47¢ to 37¢ per passenger. This has increased the subsidy per passenger from 81¢ to 90¢ per passenger. This increase in the subsidy per passenger, combined with higher ridership, has increased the MBTA's operating deficit in both current and constant 1983 dollars.

For FY 1990, the MBTA has estimated that the combination of the fare increase, the parking fee increase, and a 3.5 percent increase in ridership will generate an additional $14.6 million ($13.6 million in fare revenue and $1.0 million in parking revenue). However, due to the Local 589 arbitration award and other cost increases, the MBTA deficit is still estimated to increase from $448.7 million in FY 1989 to $486.3 million in FY 1990.

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[45]Although there are differences in the costs of providing rapid transit and bus service, as well as cost differences during different times of the day, many MBTA costs apply to both, and cannot be easily separated. For this reason, an average cost for both types of service combined is used.

[46]The slight increase in revenue per passenger from 48¢ to 50¢ per passenger is attributable to changes in the proportions of riders paying the various fares, and increases in non-fare revenue, not to fare changes.

Table 8-19
Operating Budgets and Subsidy Levels: 1983 - 1990
(All figures in 000s)

	CY 1983 Actual	FY 1984 Actual	FY 1985 Actual	FY 1986 Actual	FY 1987 Actual	FY 1988 Actual	FY 1989 Estimated	FY 1990 Budget
Operating Costs								
Basic System	$276,616	$289,193	$312,182	$339,932	$358,142	$386,003	$420,397	$450,258
Commuter Rail	$60,068	$62,558	$69,043	$70,580	$74,383	$80,753	$78,421	$88,553
Total	$336,684	$351,751	$381,225	$410,512	$432,525	$466,756	$498,818	$538,811
Debt Service	$59,675	$63,786	$68,486	$77,861	$83,263	$92,071	$104,939	$124,329
Total Operating Expenses	$396,359	$415,537	$449,711	$488,373	$515,788	$558,827	$603,757	$663,140
Fare Revenue								
Bus & Rapid Transit	$94,940	$97,499	$103,190	$104,814	$108,610	$112,214	$114,533	$128,100
Commuter Rail	$16,841	$16,814	$16,782	$17,594	$20,123	$23,544	$27,882	$33,500
Total	$111,781	$114,313	$119,972	$122,408	$128,733	$135,758	$142,415	$161,600
Other Operating Revenue	$5,543	$5,109	$5,934	$7,206	$5,968	$7,210	$7,297	$12,174
Interest Income	$7,689	$7,458	$8,300	$11,227	$9,386	$12,617	$5,388	$3,068
Total Revenue	$125,013	$126,880	$134,206	$140,841	$144,087	$155,585	$155,100	$176,842
Cost in Excess of Income	$271,346	$288,657	$315,505	$347,532	$371,701	$403,242	$448,657	$486,298
Subsidies								
State Debt Funding	$55,217	$59,333	$65,257	$73,951	$79,554	$89,713	$98,650	$116,131
UMTA Section 9	$21,338	$21,338	$26,489	$20,879	$20,607	$17,942	$18,640	$18,810
Local Assistance	$99,809	$102,305	$104,862	$107,484	$110,171	$112,925	$115,748	$118,642
State Operating Assistance	$94,982	$105,681	$118,897	$145,218	$161,369	$182,662	$215,619	$232,715
Total Subsidies	$271,346	$288,657	$315,505	$347,532	$371,701	$403,242	$448,657	$486,298
Annual Ridership								
Bus & Rapid Transit	215,422	231,045	236,370	235,465	246,251	252,381	255,201	264,100
Commuter Rail	11,346	11,158	11,274	10,456	12,521	16,267	18,621	19,100
Total Ridership	226,768	242,203	247,644	245,921	258,772	268,648	273,822	283,200
Population of MBTA District	2,612	2,615	2,619	2,618	2,618	2,618	2,617	2,617
Boston CPI	290	304.2	318	326	340	360.8	377	
Average Cost Per Passenger Trip (Excluding Debt Service)								
Bus & Rapid Transit								
Current Dollars	$1.28	$1.25	$1.32	$1.44	$1.45	$1.53	$1.65	$1.70
Constant 1983 Dollars	$1.28	$1.19	$1.20	$1.28	$1.24	$1.23	$1.27	
Commuter Rail								
Current Dollars	$5.29	$5.61	$6.12	$6.75	$5.94	$4.96	$4.21	$4.64
Constant 1983 Dollars	$5.29	$5.34	$5.58	$6.00	$5.07	$3.99	$3.24	
Average Revenue Per Passenger Trip								
Bus & Rapid Transit								
Current Dollars	$0.47	$0.44	$0.46	$0.48	$0.47	$0.47	$0.48	$0.53
Constant 1983 Dollars	$0.47	$0.42	$0.42	$0.42	$0.40	$0.38	$0.37	
Commuter Rail								
Current Dollars	$1.48	$1.51	$1.49	$1.68	$1.61	$1.45	$1.50	$1.75
Constant 1983 Dollars	$1.48	$1.44	$1.36	$1.50	$1.37	$1.16	$1.15	
Average Subsidy Per Passenger Trip (Excluding Interest Income & Debt Service)								
Bus & Rapid Transit								
Current Dollars	$0.82	$0.81	$0.86	$0.97	$0.99	$1.06	$1.17	$1.17
Constant 1983 Dollars	$0.82	$0.77	$0.78	$0.86	$0.84	$0.85	$0.90	
Commuter Rail								
Current Dollars	$3.81	$4.10	$4.64	$5.07	$4.33	$3.52	$2.71	$2.88
Constant 1983 Dollars	$3.81	$3.91	$4.23	$4.51	$3.70	$2.83	$2.09	
Per Capita Subsidy by Residents of MBTA District (Including Impact of Interest Income Debt Service)								
Current Dollars	$64.19	$67.58	$71.71	$78.64	$83.19	$89.38	$97.41	$104.17
Constant 1983 Dollars	$64.19	$64.43	$65.39	$69.95	$70.95	$71.84	$74.93	
Total Subsidies in Constant Dollars (Including Debt Service)								
UMTA Section 9	$21,338	$20,342	$24,157	$18,573	$17,577	$14,421	$14,338	
Local Assistance	$99,809	$97,529	$95,629	$95,614	$93,969	$90,766	$89,037	
State Operating Assistance	$94,982	$100,748	$108,428	$129,182	$137,638	$146,818	$165,861	
State Debt Funding	$55,217	$56,563	$59,511	$65,785	$67,855	$72,109	$75,885	

On an individual level, the fare increase will result in a reduction in subsidy levels for adult rapid transit, surface Green Line and express bus riders. For student and child riders on those modes, the fare increase will mean that subsidy levels will remain mostly unchanged. Fares for elderly riders and riders with disabilities were not increased, so that subsidy levels for those riders will continue to increase (see Table 8-20). In addition, because bus fares were not increased, subsidy levels for bus trips continue to rise.

Table 8-20
Subsidy Levels for Bus and Rapid Transit Trips

	Before Fare Increase			After Fare Increase	
	Fare	Subsidy in 1983	Subsidy in 1989	Fare	Subsidy in 1990
Rapid Transit					
Adult Cash	60¢	68¢	$1.05	75¢	95¢
Child Cash	30¢	98¢	$1.35	35¢	$1.35
Elderly & Disabled	10¢	$1.18	$1.55	$10¢	$1.60
Local Bus					
Adult Cash	50¢	78¢	$1.15	50¢	$1.20
Child Cash	25¢	$1.03	$1.40	$25¢	$1.45
Elderly & Disabled	10¢	$1.18	$1.55	$10¢	$1.60

Note: Figures based on an average cost per trip (in current dollars) of $1.28 in CY 1983, $1.65 in FY 1989, and $1.70 in FY 1990, and exclude the cost of debt service.

Subsidy Costs for Commuter Rail Service

On commuter rail, costs per passenger trip have decreased between 1983 and 1989 in both current dollars and constant 1983 dollars. In 1983, the MBTA's cost per commuter rail trip was $5.29, and the average revenue generated per passenger was $1.48, which resulted in an average subsidy per passenger of $3.81. For FY 1989, the MBTA's cost per passenger trip for commuter rail service had been reduced to $4.21, which decreased the subsidy per passenger to $2.71.

In constant 1983 dollars, the reduction in costs are greater: between 1983 and 1989, the average cost per passenger had decreased 34 percent from $5.29 to $3.48, and the subsidy per passenger from $3.81 to $2.09. However, as with bus and rapid transit service, commuter rail ridership has increased significantly (64 percent between 1983 and 1989), so that total subsidy costs have increased even though subsidy costs per passenger have decreased. In current dollars, the commuter rail operating deficit increased from $43.2 million in CY 1983 to 50.5 million in FY 1989, and is estimated at $55.1 million over FY 1989.

Therefore, although the subsidy cost per passenger has been decreasing, the fare increase on commuter rail was implemented to reduce the total deficit. For FY 1990, it is estimated that the combination of the fare increase and a 2.5 percent increase in ridership will increase revenues by $6.3 million, or 23 percent. However, even with the fare increase, it is estimated that the FY 1990 commuter rail operating subsidies will increase by $4.6 million over FY 1989.

ENVIRONMENTAL IMPACTS OF THE FARE INCREASE

Environmental impacts occur when shifts are made from MBTA ridership to other modes with larger impacts on air quality and energy consumption. Especially if passengers switch to either private automobiles or taxis, the total number of vehicle miles traveled (VMT) per passenger increase, causing emissions and energy consumption to rise. As the cost of public transportation increases, travelers generally curtail their transit use by using some other mode of transportation for the trip or not making the trip at all.

Generally, ridership levels on the MBTA have been increasing annually due to improved quality of service and capacity on the MBTA and also due to external factors (downtown Boston parking costs, growth in jobs in downtown Boston, etc.). The implementation of the fare increase, however, has caused ridership on rapid transit, surface Green Line and bus service to decline by 3,540 trips per day. As shown in Table 8-21, most of the ridership loss was in home-based work trips (2,301 daily trips), followed by other home-based trips (885 daily trips), and by non-home based trips (354 daily trips).

Table 8-21
Ridership Loss by Trip Purpose

Daily Ridership Loss by Trip Purpose	Total Trips	Percent
Home-Based Work	2,301	65%
Home Based Shopping and Home Based Other	885	25%
Non-Home Based Trip	354	10%
Total	3,540	100%

Impacts on VMT and Air Quality

With the finding of modest ridership losses on the MBTA system, resulting environmental impacts can be estimated. These environmental changes are

a direct result of the tendency for trip diversions to higher impact modes. As the cost of public transportation increases and some travelers divert from transit, one of two choices is made: (1) to take some other mode of transportation for that trip or (2) not make the trip. If passengers switch to either private automobiles or taxis, the total number of vehicle miles traveled (VMT) as well as highway congestion will increase, causing emissions and energy consumption to rise. There is no impact of a trip not made.

The magnitude of air quality impacts was estimated by projecting the change in total regional VMT based on the numbers of riders lost and the distribution of their origins and total trip mileage (See Figures 8-1, 8-2). Then, using the CTPS Regional Transit model which redistributes lost trips, a total increase of 33,487 daily VMT was estimated. This represents a 0.050 percent growth in the regional VMT total. For purposes of comparison, it was estimated that the 1981 fare increase caused an immediate increase of 230,000 VMT or about seven times this amount.

Also, if the trends which occurred in that fare increase are predictive, the estimated air quality and energy impacts are expected to be rapidly mitigated as some riders return to the system and the annual growth resumes.

Of the potential pollutants, non-methane hydrocarbons (NMHC) emissions changes are the most relevant ones to examine. Ozone is primarily a summer season problem and is not limited to urban areas. Since it takes time for the precursor pollutants to react in the presence of sunlight and high temperatures to form ozone, ozone pollution is transported, and at high levels may affect populations between 50 and 100 miles from the source of the precursor emissions.

The air quality impacts associated with such a VMT change can be calculated using EPA emission factors from their MOBIL 4 program. The following are MOBIL 4 auto emission factors selected to produce representative seasonal factors for average speeds on regional access roads:

Non-Methane Hydrocarbons (75°F at 30 mph): 1.82 grams per mile

Carbon Monoxide (35°F at 30 miles per hour): 22.45 grams per mile

Applying these estimated factors, the changes in regional emissions are as follows:

With an average change in VMT of 33,487, the average daily change in emissions would be:

Non-Methane HC	60.9[47]	Kilograms per day.
Exhaust CO	751.8	Kilograms per day.

The total added emission is small, less than .06 percent of the regional mobile source emissions within the MBTA District. Again for purposes of comparison, it was estimated that the magnitude of the ridership loss from the 1981 fare increase if it occurred today (and using MOBIL 4 emission rates) would have caused an emissions increase of:

Non-Methane HC	418.6	Kilograms per day.
Exhaust CO	5,163.5	Kilograms per day.

Since the Boston metropolitan area is not in compliance for ozone, and thus for hydrocarbon emissions, this impact, while small, is not unimportant. The carbon monoxide increases, although seemingly more significant, in fact create a smaller impact both regionally and locally. Carbon monoxide is a very localized pollutant and disperses quickly. Because the trips were distributed region-wide, it was not anticipated that CO concentrations in any one local area would be significant.

Energy Impacts Energy consumption impacts relating to the diversion of riders from transit to private automobiles occur on two levels. Initially, it is estimated that motor fuel consumption would increase by about 1,600 gallons/day due to additional VMT. The total additional fuel consumption of 584 thousand gallons per year represents one eighteenth of one percent of the annual motor fuel consumption in the state.

Relation to Air Quality Standards

The State Implementation Plan (SIP) outlines the steps the state was committed to taking over the five years (from 1982 - 1987) to attain the air quality standards. Due to delays in the reauthorization of the Clean Air Act in Congress, no plan revision has yet been scheduled, however in the interim, the previous SIP remains in effect. The Transportation Element of the SIP (TE/SIP) for the Boston Region is required to indicate how the region will continue to reduce emissions to reach the target reduction identified by Department of Environmental Protection. The progress made in the region towards achievement of the attainment standards will be deferred until

[47] For the purposes of comparison to previously generated air quality impacts from the 1981 Fare increase or from the State Implementation Plan, the reader should be aware of the differences between Mobile 2 and the new Mobile 4. Estimated emission factors under these particular conditions for the new model are approximately two times greater than the old model for a variety of technical reasons. This would be equal to approximately 31.1 Kg/day under Mobile II.

ridership returns to the system, however, the greater Boston region, will still meet its targeted reductions.

SUMMARY OF IMPACTS OF THE FARE AND PARKING FEE INCREASES

Since the fare increase was implemented in the Spring and Summer of 1989, ridership on rapid transit has declined approximately 11,530 trips per day, or 3.3 percent, from Spring 1989 levels. However, most of the riders that were lost on rapid transit appeared to have shifted to surface Green Line and bus service. Ridership on these two modes increased by 4,460 and 5,390 trips per day, or 6.3 percent and 1.4 percent, respectively. The total loss in rapid transit, surface Green Line and bus ridership was 0.5 percent, or 3,540 trips per day.

On commuter rail, ridership continued to increase in spite of the fare increase. In February 1989, average daily ridership was 47,040 trips per day; in October, it had increased one percent to 47,530 trips per day. However, this growth rate was the slowest observed since 1983, meaning that the fare increase did reduce the growth rate.

The parking fee increase reduced the number cars parking at MBTA lots by 7.5 percent through the middle of November 1989. This resulted in a loss of 1,200 daily rapid transit trips, 630 surface Green Line trips, and 190 daily bus trips. When these losses are combined with the fare increases changes, rapid transit ridership declined by 12,730 trips per day, or 3.6 percent, surface Green Line ridership increased by 3,470 trips per day, or 5.3 percent, and bus ridership increased by 3,700 trips per day, or 1.3 percent.

Prior to the parking fee increase, most lots had space throughout the day, whereas prior to the fare increase they had been filling in the AM peak. However, usage at most lots continued to exceed the number of official spaces, and was close to actual capacity. Further, the time frame for this report required use of "after" data that was collected only four weeks after the parking fee increase, which was probably not sufficient time for temporary effects to have settled out. It is probable that most lots will soon begin to fill again during the AM peak, if this has not already occurred.

Revenue and pass sales figures generally paralleled the ridership figures, although it is apparent that there was also a shift from adult cash to adult pass ridership. Rapid transit revenue through the end of October 1989 had increased approximately 19 percent compared to April, surface Green Line ridership was up 16 percent, and bus revenue was up eight percent. Pass sales for all modes and all pass categories were 3.5 percent higher in October 1989 than in October 1988.

The environmental impacts upon riders with an automobile available is measured in terms of environment impacts such as increased vehicle miles traveled, traffic congestion, and air pollution. The impacts on riders who do not have access to an automobile (so-called "captive" riders) and are forced to forego trips is measured in terms of socio-economic impacts such as decreased access to employment, educational, social and health care opportunities, and less income available for other needs.

Typically, fare increases result in lower ridership losses in captive ridership because these riders have fewer alternatives. As a result, impacts on these riders are usually socio-economic in nature. Conversely, ridership impacts are often greater among more affluent riders because they usually do have other alternatives available. To the extent that these riders shift from transit to automobile, there will be adverse environmental impacts. The 1989 fare increase was designed to minimize both types of impacts to the greatest extent possible. This was done by holding bus and surface Green Line fares level, and increasing fares for the most expensive fares proportionally less than other trips. Also, discounts for elderly riders and those with disabilities were maintained. The result was that many low income and transit dependent riders were not affected at all, and for many those that were, a lower cost alternative (bus service) was provided. The reversal of the historical decline in bus ridership following the fare increase indicates that many riders did make this shift. Furthermore, for riders that were affected, the cost increase was a relatively small five to eight dollars per month, which is not large in relation to other costs.

Changes in the number of vehicle miles travelled (VMT) in the region were small, especially when seen relative to total regional travel. The total increase of 33,487 per day represents primarily the losses in commuter rail ridership which, when diverted to automobile trips, incur far more VMT than do local (i.e., bus and rapid transit) trips. The air quality impacts related to this change in VMT were also small (60.9 kg/day of non-methane HC and 751.8 kg/day of exhaust CO). They must further be weighed against alternatives which would cause reductions in MBTA service quality or efficiency. In the long run, maintaining transit services is expected to have an overriding positive air quality impact in that the ridership will resume its growth and that the current market share will not be eroded.

9. MBTA Funding: Existing and Potential Sources

MBTA FUNDING

The MBTA is aware that raising fares is never popular, and since 1982, fares have remained unchanged. During that same time period, ridership has grown steadily, major service improvements have been made and management programs have controlled costs. Nevertheless, the cost of operating the MBTA has increased about six to seven percent annually. These increases reflect inflation and new operating costs associated with the various service expansions.

Between 1982 and 1989, the MBTA had been able to avoid increasing fares because the State, in turn, had been able to provide additional operating subsidies as an alternative. Due to budget constraints in 1989, state funding became limited. At the same time it was apparent that the impacts of inflation had resulted in significant devaluation of fares. This consideration, coupled with service improvements in recent years, made a fare increase a fair and reasonable approach to raising additional revenue. When it was decided that a fare increase was warranted, the MBTA reviewed the experience gained from the Fare Increase of the early 1980's to determine the least destabilizing method of adjusting fares. Two key points were considered vital in implementing the 1989 changes: (1) that the increase be a reasonable one; directly required by the inflation rate and/or the costs of significant service improvements and, (2) that any proposed increase and the reasons for it needed to be well-explained to the riding public. On this basis, the fare increase, described in Chapter 6, was implemented in the Spring of 1989.

The only alternatives to the fare increase considered were an increase in financial assistance from the MBTA member cities and towns and from the State, or a cut in service. Due to budgetary constraints at both the local and/or state level, increased funding from these sources was not considered realistic. The service cut alternative was considered as the least desirable method and was only analyzed for relatively small-scale use as a measure to improve system efficiency.

The 1989 fare increase was designed to mitigate impacts on certain user groups without altering overall MBTA services. A marketing campaign which accompanied the announcement of the increase, focussed on the fact

that even after the fare increase, MBTA fares would still be among the lowest in the country. In addition, a package of measures was initiated to keep fares low for certain groups, to encourage pass use through discounts and simplified pricing structures, and to eliminate inequities in fares for the Newton portion of the Green Line. In summary, the fare increase package included the following measures:

1) Local bus fares were left unchanged.
2) Fares for senior citizens and the disabled were left unchanged.
3) Express bus and commuter rail fare increases were varied depending on the distance of the trip.
4) Token 10-packs were introduced that provided 11 trips for the price of 10.
5) Monthly pass price increases were delayed for two months (thus offering a 37 percent savings for pass users for two months) as a way of encouraging pass use,
6) Monthly passes were redesigned to make them easier to understand.
   - The new system created four major passes -- Bus, Subway, Combo (both bus and subway use), and the Combo-Plus (which allows use of virtually every T service except for the longer distance express bus and commuter rail trains).
7) Half-fare coupons were provided for Green Line riders who get on and off in Newton. The coupons eliminated the existing inequity of charging the same price whether a passenger rode a couple of stops in Newton or all the way in to Boston.
8) Finally, the MBTA agreed to propose a method for passengers counts and ridership estimates and to develop a preliminary baseline count for use in evaluating the impacts of the fare changes. The results of that portion of the agreement are presented herein.

To be effective, fare policy must be consistent with the decision-making in other aspects of system operation, notably service planning and finance. Service issues were discussed in detail in Chapter 3. This section describes the direct and indirect benefits that transit provides and how those benefits can be used to establish a fair distribution of subsidy income. Further, it explores issues which will need to be considered in balancing future MBTA funding. A number of alternate mechanisms will be detailed and compared as to their revenue potential, stability of funding, potential impacts and their costs of administration.

Transportation Subsidies

Each year, the Federal and State Governments provide significant funding for highway construction and maintenance. Highway pricing policy has been based on the notion that highway costs are paid from indirect taxes, with fuel taxes and infrequent toll facilities being the only direct user charges. As a result, the price of an auto trip rarely reflects the true costs of the trip. In the

Boston region, it has proven difficult to establish successful peak-period strategies which would impose some type of real cost on highway use during peak hours. As travel has increased, the user costs of highway congestion have begun to derive directly from the time costs of congested roadways and these "costs" begin to favor transit.

Similarly, transit trips are subsidized for the purpose of increasing ridership and reducing highway congestion. The purpose of fares is somewhat different for public authorities, such as the MBTA, than it is for private transit operations. In the case of private operators, fares must be set to both cover costs and to provide a profit margin to the owners. In the case of transit in the United States, the primary purpose of fares is to assess users an acceptable fare that will defray system costs. Fare levels are also used to achieve certain social objectives such as improving the mobility of the transit-dependent, or providing an alternative to the private automobile.

Transit System Benefits

Funding the MBTA is a matter of balancing a number of income sources to produce an income stream-mix which represents those who use the system as well as those who benefit from the system. This is based on the public policy that all who benefit from the system should contribute to its costs, and in the Boston region, the MBTA provides a service that provides value to both users and non-users.

Financial support for transit also produces a number of different types of benefits to a variety of groups, both users and non-users of the services. Transit riders benefit directly from the financial support which subsidizes their fares. That is to say, the real direct cost of rapid transit services for all services divided by the number of trips provided shows that the average transit trip for which a rider pays 75¢ actually costs somewhere between $2.00 and $3.00 to provide. If transit services were not available, commuters would need to find other ways of getting to work, probably at much greater expense.

Non-users benefit when improved access increases land values around transit stations, and businesses benefit by being able to attract employees and customers more easily and from an expanded geographic base. Non-transit users also benefit from transit service through reduced traffic congestion – the MBTA carries approximately 600,000 linked trips per weekday, most of which would likely be auto trips without transit service. In addition, according to patronage forecasts prepared by the Central Transportation Planning Staff for the South Boston Piers Transit Feasibility Study, Draft Environmental Impact Report, the MBTA carries approximately 50 percent of all work trips to downtown Boston, thereby significantly reducing rush hour traffic volumes.

Other adjunct benefits are also achieved in the attainment of lower levels of air and noise pollution and in the form of dense development which brings a reduction of costs for the provision of many urban services. The benefits which accrue to society as a whole are supported by federal, state and local income sources as well as by the individuals who use the system.

PRESENT FINANCING METHODS

In most states, transit properties have one or several dedicated funding sources such as sales tax revenue and gasoline excise taxes which flow directly to the authority. These funds are normally calculated in the transit system's earnings and not in the portion received from the state. In Massachusetts, many of the same funding sources flow to the state first and then are dispersed through the legislature. Thus, in Massachusetts, transit agencies are much more reliant on direct state funding than elsewhere in the country.

Over the past decade, state assistance to the MBTA has increased while federal and local aid has decreased as a proportion of the MBTA's funding. For example, from 1981 to 1987, the state contribution towards the MBTA went from 39 percent to 50 percent of the total MBTA revenue, local assessments dropped from 24 percent to 21 percent, federal aid was reduced from 7 percent to 4 percent and collected MBTA fares which comprised 30 percent in 1981 fell to 25 percent. Since 1982, collected fares have dropped as a proportion of the total MBTA revenues although the total has increased due to overall increases in ridership.

Fare Revenue

With constant fares between 1982 and 1989, fare revenue has grown only as fast as ridership. While ridership increases between 1982 and 1989 were fairly large averaging over three percent per year, this rate was lower than the increase in costs, so fares also now fund a lower proportion of the deficit. In the future, ridership is expected to increase by approximately 3.5 percent per year, while operating costs are expected to increase by 6 percent per year. Therefore, with constant fare levels, fares will continue to fund less of the operating deficit.

Federal Funding

Federal involvement in funding public transit began in 1964. The amount of federal funds available peaked in the late 1970's in response to energy shortages and has been declining since then. Since 1982, UMTA grants have dropped by nearly 70 percent, after adjusting for inflation, from $250 million in 1982 to $80 million in 1988.

In Boston, approximately 4 percent of the transit operating funds for the MBTA are federal funds.[48] The combination of public funding cutbacks and increased transit demands nationally have served to intensify competition for available federal dollars, especially for capital projects. In 1989, an UMTA policy was proposed for initiation which gives preference in UMTA's grant review process to projects that overmatch the statutory 25 percent in non-federal funds. Other things being equal, the larger the overmatch of federal grant funds, the higher priority the project will be given by UMTA. Furthermore, an application with privately raised overmatch funding would outrank one with public overmatch funding. While this funding policy will cover primarily capital project funding, it indicates that UMTA is trying to leverage maximum amounts of private funding. Similar policy directions have been proposed for operating funds and it is clearly a policy which UMTA is interested in pursuing.

A large amount of uncertainty exists concerning the future of federal support. Although Congress has been supportive, current proposals at the federal level provide for a continued reduction of transit operating subsidies. These funds currently help to reduce the operating deficit of the Authority and therefore, help reduce the financial impact on the State and the cities and towns in the MBTA district. At the present time, this assistance is anticipated at the same level for the near future as had existed in 1988.

Local Funding

In addition to a declining federal funding picture, Proposition $2^1/2$ has capped increases in the local share of transit operating expenses to $2^1/2$ percent per year. Since operating expenses have increased at an average of 9 percent per year, local assessments are funding a lower proportion of the deficit each year, down from 29 percent in 1981 to 21 percent in 1987.

State Funding

The major source of MBTA funding is state-derived and it is the only source which has seen significant increases during this decade. The MBTA benefitted from the healthy Massachusetts fiscal situation and from 1981 - 1987, with the state share of the MBTA funding increasing from 39 percent to 50 percent.

Although, MBTA costs have increased at a lower rate than have other state expenditures, and state revenues, state subsidies have increased at a much higher rate in response to the severe limitations on other funding and the

[48]Some of this funding is received through localities which receive commuter rail service, but which are outside of the MBTA district. The reimbursement is provided to the outside districts by the federal government.

State's commitment to public transit. Based on the State's worsened fiscal condition, the issue of continued increasing state share must now be examined in the event that the State at some point becomes unable to continue to pay for the gap between costs and other revenue sources.

Other Existing Revenue Sources

Advertising - The use of paid advertising in MBTA Stations and Cars provides a small additional source of revenue for the MBTA, currently about $2 million per year. A contract for the management of all advertising is sent out to bid for a four year term (with a two year extension possible). Currently, the agency which won the last bid is in its fourth year of the contact. This company handles all aspects of advertising and turns over 58.5 percent of its gross revenue to the MBTA. For aesthetic reasons, exterior advertising is being phased-out and thus it is expected that gross revenue will be reduced somewhat in coming years. New sources of advertising income planned are the addition of a moderate number of new station poster sites, electronic signs, clocks, and bus shelters. A plan for siting these items is being developed. In addition, advertising space on the system map and on some schedules and maps is being introduced. It is anticipated that this revenue will help to defray the cost of printing for these collateral materials. Overall, advertising is expected to remain stable as a source of revenue in the coming years.

Fiber Optics - Like all cables, fiber optic lines need to travel in a right-of-way, but unlike some other types, fiber optic cables are compact and quite safe. The use of existing MBTA tunnels and rights-of-way is seen as advantageous to the fiber optics industry in Boston, since communications companies can lease MBTA tunnel space as ready-made cable rights-of-way. Furthermore, because the tunnels are not covered, open access to the cables for repair work can be maintained without digging up roadways or disrupting MBTA operations. Therefore, leasing cable space to fiber optic companies, provides a new revenue source to the MBTA. (In addition, when establishing contracts with cable companies, the MBTA negotiates to have MBTA communications cables installed concurrently with the private cables. Thus part of the income which the MBTA will receive is actually service, in lieu of the costs which the MBTA would normally have incurred to install their own communications network.)

Presently, it is unclear what the potential for fiber optic revenue will be in the long-run. The market is very fluid and competitive. The MBTA expects to receive some services in exchange for right of way use. Table 9-1 provides a listing of the existing fiber optics contracts. The current best estimate of future fiber optics leasing revenue is that it will become a moderate source of new revenues.

Table 9-1
Existing Fiber Optics (ROW) Lease Agreements

Communication Company	Location	FY 1990 Revenue
US Sprint	Riverside & Fenway	$18,650
MFS McCourt	South Station Church Green	$15,500
AT & T	Central Subway	$54,876
Teleport Boston		$10,000
Total Fiber Optics Revenue		**$ 99,026**

Existing Facilities Leasing - The MBTA has extensive land holdings in land used for stations, tracks, maintenance facilities, ROWs, etc. Where the public transportation uses of the land will not be compromised, concession leases are being pursued.

An example of this concept is the new South Station renovation, where the transit use of the space has been augmented and enhanced by the construction of space for auxiliary services. Services such as coffee shops, newspaper stands, barber shops, and shoe shine booths are traditional for railway stations. In addition to these, the MBTA has provided concession spaces for diverse small businesses, thereby enhancing revenue and the convenience of the station for its users. There are some cases where the private uses of the land could be yet larger as a proportion than at South Station and where the transportation uses might enhance a development of another type.

These uses not only serve the public and enhance the atmosphere and usefulness of the station, but also provide revenue for the MBTA. A number of other stations including Lynn and Alewife have such concession space included in their design and several others such as North Station are being considered for such treatment. Lease plans for the Downtown Crossing stop are underway. Table 9-2 provides more detailed information on the existing joint development projects and lease agreements which the MBTA has entered into.

Table 9-2
Existing Joint Development and Lease Agreements

Location	Type	FY 1991 Revenue	Comments
Newton Centre Station	35 year lease	$18,650	Plus station and platform maintenance ($20,000 savings).
Auditorium Station	35 year lease	$20,115	Plus $50,000 in one-time capital improvements and 50% of annual station cleaning costs (approx $12,000 in FY 1991).
Alewife Station	10 1/2 year leases	$118,000	Plus 50% of cash flow in excess of $121,000 and maintenance savings of $16,368.
South Station	35 year lease	See comment	50% of net income to offset MBTA share of operating and maintenance costs.
Mt Auburn St. (Brattle Square)	99 year lease	$115,400	
Bennett St. (Cambridge)	lease	$70,000	Plus drivers' office/lobby.
East Eagle St. (East Boston)	5 year lease	$7,625	
Total		$349,390	

Another example of use of MBTA lands can occur when developer's are interested in building in the air rights over a station, over rail yards or terminals or along rights of way. For uses which are compatible with the sound and vibration of rail services and where MBTA service will not be negatively affected, this can serve the dual purpose of providing additional lease revenue and improving the attractiveness of the MBTA as a whole. The MBTA has engaged in studies of several of its stations for a prototype

joint development project. Although a sound concept which would yield additional revenues, the joint development concept has not yet been fully exploited. To date several suggested sites for joint development have been unsuitable candidates because of site considerations, environmental issues or the fact that their use was seen as having the potential of precluding future expansion of transit uses.

FUTURE FINANCING OPTIONS

The present funding sources of the MBTA, which were identified earlier, include the federal, state, and local governments and the MBTA passengers. As the federal government operating subsidy is being phased out and local government finances are being restricted by Proposition 2^1/2, alternative sources of funding are being sought. The state's share currently comes primarily from the general tax fund and gasoline taxes; the local share comes from property taxes.

Revenue sources for transportation can be placed in two categories; transportation-related sources and general revenue sources. Revenue options relating to transportation sources include transit fare increases, real estate related mechanisms such as leases, and fiber optics leases, increases in advertising, parking fee increases, bridge and highway tolls, taxes on vehicles and their use; such as parking taxes, auto excise, and other excise taxes and taxes on gasoline. General revenue options are more broadly based and include such mechanisms as property taxes, income taxes, sales taxes, payroll or employer taxes and a variety of types of development taxes.

A brief evaluation of these revenue generation methods was conducted to provide an overview of mechanisms for further study. To facilitate the evaluation, each was examined based on three categories of criteria: future revenue potential, the practicality of implementing and administering the revenue source, and other impacts.

Evaluation Criteria

Revenue Criteria In reviewing alternative funding sources, the amount of revenue potential was the most important concern, followed by the stability of the revenue source. Once implemented, the revenue obtained will be relied upon for future transit support, and ideally, should not be subject to dramatic fluctuations from year to year. How the revenue source relates to other economic pressures such as inflation and employment rates is also important. For example, during inflationary periods, sources which provide constant levels of income, produce an income stream of decreasing real value. Ideally, income sources should be of increasing value during inflationary times. A final criteria is the transit system's ability to respond

well in times of energy shortfall or major price increases. Some funding mechanisms will work well to assist the MBTA to respond to such crises, however others may not engender stability during such periods. During the last decade, energy supplies have not been a major public concern; nevertheless, the MBTA needs to remain prepared for energy shortages since it is at such a time that the region's residents would be most dependent upon mass transportation.

On this basis. the principal revenue criteria used were:

- The potential yield from the revenue source.
- The stability of the revenue source.
- Ability of the revenue source to keep pace with inflationary trends.

Administrative Criteria Administrative criteria refers to the ease of implementing the revenue source and of collecting and distributing the revenue. Included is the institutional environment and any potential barriers towards the implementation of a given revenue method.

These include:

- Political acceptability
- Existing mechanisms of administration
- Ease of implementation
- Cost
- Whether legislative changes would be needed
- Whether the measure is used in Massachusetts (and if so, is it used for transit funding or general revenue)
- Whether the measure is used in the US (and if so, is it used for transit funding or general revenue)

For any type of revenue source to be implemented, it must be politically and publicly acceptable. Although the general mood of the public towards tax increases has been extremely negative in recent months this will not likely always be the case. However, some forms of taxation are generally considered more onerous than others in any political climate. Income taxes, for example, are generally subject to serious negative reaction.

Other Impacts In addition to the above criteria, other significant concerns would be the progressivity and the equity of the revenue source, as well as the impact of transit and automobile use. This would include who will be paying any given revenue charge, to what extent it will be burdensome, and to what extent it would be progressive, proportional, or regressive. Regressive taxes are those that are not sensitive to the income levels and charge a flat amount to all that pay the tax. For example, a $100 a year transit tax on all downtown employees would be a regressive tax because a worker earning $12,000 a year

and one earning $200,000 a year would pay the same amount. For the first employee, the transit tax would equal .83 percent of annual income and for the later .05 percent of annual income. A proportional tax would be one in which all persons pay the same *rate*, but where higher income persons would pay a greater amount than lower income persons. A 1/4 percent transit payroll tax would cost the first employee $30 per year and the second $500 per year. Progressive taxes would charge high income persons a higher rate than low income persons. An example of this type of tax is the federal income tax, in which the tax rate increases as income increases.

Revenue sources should also be fairly assessed to those who would benefit and that benefit should be fairly applied in time. (Would a proposed revenue measure tax all people or corporations evenly, or differentially? An example would be a fee that is due to all developments completed by a certain date. If a developer could delay the completion date of a project to avoid a fee being levied, it would not be equitable.) Lastly, impact criteria also includes the impact which the measure would have on transit and automobile usage, if any.

On this basis, the other impacts considered were:

- The progressivity of the measure,
- The equity of the measure,
- The ridership impact which the measure would have, if any, and
- The impact of the on automobile use, if any.

POTENTIAL REVENUE SOURCES

On the basis of the above criteria, a number of potential funding sources were examined. These potential sources, are as listed below. In addition, a summary of findings on their potential revenue yields, impacts and administrative ease of implementation is presented in Table 9-3.

- **Transit - Related Alternatives**
  - Transit Fare Increases
  - Advertising Revenues
  - MBTA-Owned Real Estate
    - (including leases of MBTA right-of-way for fiber optics)
  - Transit Parking Fee Increases
- **Other Transportation - Related Alternatives**
  - Motor Vehicle Fees
    - Registration and Excise Taxes
    - Driver's License Fees
    - Gasoline Taxes
  - Bridge, Tunnel and Highway Tolls
  - Windfall Profits Tax in Parking Freeze Districts

- Non-Residential Parking Surcharge
- District-Wide Parking Surcharge
- Special Road Use Charges

• **General Revenue Measures:**
- General Sales Tax (including motor vehicles)

• **Dedicated MBTA Property Tax:**
- Real Estate Assessments
- Dedicated MBTA Benefit Assessments

• **Value Capture Techniques**
- Public Private Partnership
- Development Parking and Impact Fees

• **Dedicated MBTA Income-Based Taxes:**
- Dedicated MBTA Income Tax
- Dedicated MBTA District Payroll Tax

Transit-Related Revenue Sources

Transit Fare Increases – Fares are a direct charge to the users of transit. Because of the cost of operating transit and the subsidies provided to competing travel modes, transit fares cannot be set at levels to pay the full cost of the system and serve an acceptable share of the travel market. However, users can be expected to pay a transit fare related to the overall costs of operating the transit system.

Revenue
It is estimated that the 1989 fare increase will generate approximately $12.1 million dollars in additional revenue each year.

Impacts
The impacts of the fare increase are reviewed elsewhere in this document. To summarize, the ridership losses were slight and were partially mitigated by an unchanged fare for local buses and the bulk sale of discount tokens and the three month delay in pass price increases. In addition, the rate of inflation for the interval between fare increases had surpassed the change in fares.

Administration
Fare increases are relatively inexpensive to institute. Administrative expenses are the costs of monitoring the impacts of the increase, the public hearing process and marketing and printing costs. New system maps and fare structure cards, and many types of collateral marketing information are required. Political feasibility for fares increase depends on public perception of the quality of the fare increase, the time between increases and the rate of inflation.

Table 9 - 3
Alternative Transit Revenue Sources

Transportion Related Revenue Alternatives	Revenue Criteria: Potential Revenue (in Millions $)	Rate	Stability	Inflation Resistance	Impacts: Progressivity	Equity	On Transit Use (Ridership Change)	On Automobile Use	Administration: Political Acceptability	Existing Mechanisms	Ease of Implementation	Cost	Legislative Change	Used in MA*	Used in US
Transit-Related Alternatives															
Fares	16.8	to $1.00	high	low	low	high	low	high	low	yes	good	low	no	T	√
Advertising	2.0	varies	high	high	n/a	high	n/a	n/a	high	yes	good	low	no	T	√
Real Estate including Fiber Optics	2.5 - 10.5	varies	medium	high	none	high	high	n/a	high	yes	good	low	no	T	√
Transit Parking Fee Increases	4	+$1 •	high	low	low	high	low	high	low	yes	good	low	no	T	√
Other Transportation Related Revenue Sources															
Motor Vehicle Fees Registration taxes	5.4	$10	high	low	low	low	none	low	low	yes	good	low	yes	G	√
Motor Vehicle Fees Drivers license fees	1.8	$5	high	low	low	low	none	low	low	yes	good	low	yes	G	√
Motor Vehicle Fees Gasoline taxes	20	6¢/2¢/2¢	high	low	low	low	high	low	medium	yes	good	low	yes	G/T	√
Bridge and Highway tolls	4.5 - 18	varies	low	high	low	low	high	low	medium	yes	good	low	yes	G	√
Windfall Profits Parking Tax (in parking freeze areas)	10 - 15	$1/day permit	high	low	high	low	n/a	low	low	no	poor	unknown	unknown	no	no
Non-residential Parking surcharge	5.8	$100. per space	high	high	high	low	n/a	low	medium	no	poor	medium	unknown	no	no
Parking surcharge (District-wide)	14	$1/day permit	high	low	low	low	high	low	low	no	poor	medium	yes	no	no
Special Road Use Charges	varies	varies	high	low	low	low	high	low	low	no	poor	high	yes	no	no

• parking fee increase of $1. at most stations

* Taxes collected for
G=general revenue purposes
T=taxes collected are transit dedicated

Table 9-3 (continued)
Alternative Transit Revenue Sources

General Revenue Alternatives (to be transit-dedicated)	Revenue Criteria: Potential Revenue (in Millions $)	Revenue Criteria: Rate	Revenue Criteria: Stability	Revenue Criteria: Inflation Resistance	Impacts: Progressivity	Impacts: Equity	Impacts: On Transit Use (Ridership Change)	Impacts: On Automobile Use	Administration: Political Acceptability	Administration: Existing Mechanisms	Administration: Ease of Implementation	Administration: Cost	Administration: Legislative Change	Administration: Used in MA*	Administration: Used in US
Dedicated MBTA Sales tax	160-240	1%	poor	high	low	low	NI	NI	medium	yes	high	low	yes	G	√
Dedicated MBTA Property Tax Dedicated Real Estate Assessments	varies	varies	good	high	low	low	NI	NI	low	no	medium	low	yes	G	√
Dedicated MBTA Benefit Assessments	varies	varies	good	low	high	high	high	NI	medium	no	medium	low	yes	No	√
Dedicated MBTA Value Capture Development Density Uses	varies	varies	good	high	high	high	high	NI	high	no	low	low	no	No	√
Development Parking Fees	varies	varies	good	high	high	high	high	low	medium	no	medium	low	yes	No	√
Development Impact Fees	varies	varies	good	high	high	high	NI	NI	high	no	medium	low	yes	No	√
Dedicated Income-based Taxes Dedicated MBTA Income Tax	72	.50%	high	high	high	low	NI	NI	low	yes	good	low	yes	G	√
Dedicated MBTA District Payroll Tax	200	.50%	high	high	low	low	NI	NI	low	yes	good	low	yes	No	√

NI = No Impact

* Taxes collected for
G=general revenue purposes
T=taxes collected are transit dedicated

Advertising Revenue – As discussed previously, advertising on the MBTA system consists of materials such as posters and car cards which are placed in stations and in vehicles. Exterior advertising, once allowed on buses and trolleys is being curtailed gradually. New shelter advertising is not currently being pursued. New advertising space, however, is being planned for use on schedules and system maps in the future.

Revenue
The revenue from advertising is currently about $2 million per year, but expected to decline slightly in the next few years and then will stabilize.

Impacts
Uncontrolled advertising creates a feeling of disorderliness and clutter in stations. If allowed throughout the system without regard to aesthetics, advertising could have a negative effect on user satisfaction. However, as currently permitted, in moderation and in a well-maintained orderly presentation, advertising is seen as having little impact on system use or user satisfaction.

Administration
The existing administrative system appears to work well and has allowed contract management of advertising by an outside, lowest bidder.

MBTA Owned Real Estate – The MBTA's substantial land holdings are a potential source of of revenue. Use of the air rights to MBTA land exists in the densely developed downtown. Many stations are below downtown development and the location serves to enhance the developments access and value. To date the costs of construction have limited the financial feasibility to the downtown and most expensive parcels of land. In the future, such leases, could be pursued actively as a source of MBTA income. Table 9-4 lists some potential future joint development projects as well as some future lease revenue opportunities. The listing of these projects is not intended to indicate that implementation is certain. They are provided to give a sense of the types of projects and the level of future revenue potential which the MBTA might be able to achieve.

Revenue
All together, leases and short-term rentals of all MBTA real estate produces just under $2 million annually. A potential future revenue ranges from between $2.0 and $10.0 million depending on a number of market factors including the general state of the Boston real estate market. Including fiber optics leases described earlier, this combines to produce a range of between $2.2 to 10.5 million.

Table 9-4
Potential Future Joint Development/Lease Revenue

Location	Type	Projected Revenue	Comments
Summer St Vent Shaft Site	rental	dependent upon market conditions	To be developed for market rate housing, revenue beginning in FY 1992.
StationPark (Rt 128/Dedham)	unknown	unknown	No income projected until at least FY 1994.
SW Corridor Parcel 18	lease or sale	$1.6 m (sale) $160,000/yr (lease)	Development agreement with BRA.
Summer St Concourse	lease	unknown	Under study for concession/commercial uses.
Lynn Station	lease and/ or sale	unknown	Under study for retail use and development of remnant parcel
Broadway Parcels D & F	lease	$41,000/yr	Expected in FY 1991.
SW Corridor Parcel 22	affordable housing development	unknown	Joint development with City of Boston Public Facilities Department.
SW Corridor Parcels, 65/65A/66	sale	net $12,000 in FY 1991	Low and moderate housing (revenue is net after repaying UMTA share of acquisition cost.
Roslindale Substation	lease	unknown	Negotiations underway.
SW Corridor Parcel 245	sale	$40,000 in FY 1991	Revenue is net after repaying UMTA share of acquisition cost.

Table 9-4 (Continued)
Potential Future Joint Development/Lease Revenue

Location	Type	Projected Revenue	Comments
SW Corridor Parcel 25	unknown	unknown	Under study for commercial/industrial use.
SW Corridor Parcels 69/70/71	lease	based on appraisal	Negotiations underway.
SW Corridor Parcels 30-33 & 45	sale	$22,000 in FY 1991	Affordable and market rate housing.
Egleston Square (Roxbury)	sale	unknown	Study underway.

Impacts
In certain locations, the use of land for air rights development might curtail transportation uses of the lands and this could negatively impact ridership growth potential. In most cases, however, joint uses add to the attractiveness of transit mode use.

Administration
Real estate administration can be somewhat difficult to administer in that private improvements may require public investments to be feasible. In some cases legislative approval may be required.

Real Estate Leasing of Rights of Way for Fiber Optics – The use of MBTA tunnels as rights of way for cabling is a new revenue source enabled by the development of fiber optic communications.

Revenue
The potential revenue available from fiber optic leasing is not yet fully known. Initially when the technology appeared, it seemed to be a lucrative new revenue source, but more recently significant revenue potential appears less certain. Currently, the MBTA is taking advantage of this revenue source primarily in leases totaling slightly under $100,000 per year in obtaining services and some lease income but presently, it doesn't represent a significant revenue source.

Impacts
No significant impacts are anticipated.

Administration
Administration of fiber optics leasing is handled by the real estate department since it is a standard use of MBTA Right of Way. There is an existing administrative structure and no problem is anticipated in terms of political feasibility or ease of implementation.

Transit-Related Parking Fee Increases – Previously, there were no fees at many MBTA stations. In the fall of 1989, parking fees were instituted at commuter rail parking lots and price increases were seen at transit station parking lots.

Revenue
Systemwide, the parking fee increases have increased the average revenue per car from $1.56 to $2.56, and revenue from $19,115 to $28,950 per day. This 51 percent increase in parking revenue will generate an additional $3.6 million, increasing parking revenue from approximately $7.0 million per year to $10.6 million.

Impacts
As described in detail in Chapter 8, a decline of 1,220 cars per weekday parking at MBTA lots translates into a loss of approximately 2,020 trips per average day (2,680 weekdays, 1,110 weekends). Nearly all of the decline occurred on rapid transit and the surface Green Line. Compared to April 1989 ridership, the ridership loss is about 0.3 percent on rapid transit, 1.0 percent on the Green Line, and less than 0.1 percent on bus service. These percentage decreases are small because the proportion of MBTA riders affected by the parking fee increases was relatively small. The parking fee increases were applied to 15,109 spaces, which, before the parking fee increase, accounted for 29,300 of a total of 722,100 daily trips systemwide, or only four percent of total ridership.

Administration
Some new administrative costs were incurred in the installation of fee collection stations and barricades for re-marking the entrance and exits of the parking lots. Administration of the lots is simple and will be handled as are the existing MBTA parking facilities.

Other Transportation-Related Revenue Sources

Motor Vehicle Fees – Motor vehicle fees currently take the form of registration fees, vehicle sales taxes and excise taxes. Presently, in Massachusetts, none of these taxes are transit-dedicated. Registration fees are presently imposed as a flat rate fee of $45. ($40. if the registration is completed by mail). They are collected every two years for each vehicle registered in the

Commonwealth. In some states, registration fees are based on the age of the vehicle or the weight of the vehicle. Excise taxes on motor vehicles are imposed by the cities and towns of Massachusetts. Generally formulated as a personal property tax on private automobiles, this tax is used by at least other 32 states. Some states do share this tax directly with the local transit districts (Washington State, for example). The tax is generally imposed based on the age of the vehicle which lessens the regressive impact. (Sales taxes on automobiles are discussed in this chapter under general revenue taxes since the operate identically to other state sales taxes.)

Revenue
Based on recent trends and a total of 1,579,522 vehicle registrations in the MBTA district for 1987, it is estimated that there currently exist approximately 1,610,000 vehicles in the MBTA district in 1989. At a rate of $10. per registration and at a rate of 540,000 new registrations per year it is estimated that this measure would bring in approximately $ 5.4 million.

Impacts
Although car sales are currently slow, it is not anticipated that moderate sales tax increases would have major negative long term impacts on highway use or on car sales. Given the cost of automobiles, such fees are generally added as marginal costs and do not have major impacts on vehicle purchases. A sales tax would be a relatively progressive type of tax to implement on cars, probably somewhat more progressive than general revenue sales taxes are.

Administration
The administration of registration fees and additional auto sales taxes would each be easy to administer since they are all existing state collected taxes for which administrative structures are in place. Legislation would be needed to redirect such fees to fund transit. The collection of additional auto excises taxes would need to be accomplished at the local level and would require a collection mechanism and legislation to permit dedication of the funding for transit uses.

Driver's License Fees – Drivers license fees are charged to individuals when they first obtain their driver's license and for subsequent renewals. There are already substantial licensing fees in the State of Massachusetts.

Revenue
A dedicated $5.00 additional fee for a driver's license would generate almost $1.8 million dollars in revenues.

Impacts
Flat rate license fees are regressive since they are uniform for all drivers. While they will have no impact on transit ridership and would likely

have virtually none on automobile use (unless they are imposed at a very high level) they would carry high political infeasibility.

Administration
Ease of administration of such a fee would be high since all administrative structures currently exist to collect such fees. New legislation would be needed to dedicate such a tax.

Gasoline Taxes –There is a gas tax package currently in the Legislature for the funding of many transportation projects in the region. Massachusetts now has one of the lowest gas tax rates in the country and it is currently the lowest in New England. The current legislative proposal calls for a 6¢ increase this year and another 2¢ increase in 1991. The first phase of the increase would put us at the national average. As it currently stands, the Massachusetts gas tax supports several funds and 84.5 percent goes into a transportation fund. Of this transportation fund, a portion goes into local aid for the cities and towns for transportation-related expenditures and up to 20 percent of mass transit costs. If the MBTA line items continue to be funded at the rate of 20 percent from the Highway Fund and 80 percent from the General Fund the increase in the gas tax will cover a $51 million increase in the MBTA share in FY 1991. Currently the statue requires 15 percent of the gas tax revenue be dedicated to the cities and towns for local assistance in highway construction and maintenance. As currently drafted, the gas tax legislation would extend this allocation to the increase. A proposal exists to use these funds to offset the increase to the Commonwealth subsidy of the MBTA caused by Proposition 2½. This proposal would greatly assist in providing funding for the MBTA operating costs.

Revenue
Gas tax and auto use charges are used in many other parts of the country as a way of funding transit, since such charges tend to reverse some of the inherent subsidies given to the automobile in the funding of public roadways and automobile services. Furthermore, such fees tend to cause a reduction in auto use, which in turn, improves air quality and reduce energy consumption. By inversely linking gas prices and fares through a gas tax, not only will auto use directly subsidize transit, but there will also be incentives for auto users to utilize the transit system. The transit-dependent would pay less and the middle class more, but people could control their costs by driving less or carpooling. As a revenue source, it would generate as much as $20 million annually in the district. Five metropolitan transit systems currently use gas taxes.

The per gallon gas tax is insensitive to inflation and it can be raised only by a vote of the State Legislature, which is usually difficult to accomplish. The demand for motor fuel is relatively inelastic to price with general estimates citing that a 10 percent increase in price will reduce

consumption by only about 2.1 percent in one year and by about 7.6 percent over the 10 year period. Also, this form of taxation is vulnerable to times of energy crisis, when transit funding will be most needed, and as such, this is a draw-back.

Impacts
About 30 percent of all motor fuels are used in the commercial transportation of goods and so for this segment, when taxes rise, the cost is felt by all consumers in the price of goods.

Although some analysts would have found gasoline taxes to be progressive across the board, there seems to be a difference in the tax based on trip type. For the poor without motor vehicles, a shift in taxation from transit fares to a gasoline tax, for example. would be progressive, not withstanding the overall pass-on to all consumers for the increased price of goods. However, for auto owning low and moderate income households which use their vehicles for necessary trips such as work-trips gasoline taxes are relatively regressive taxes. For discretionary trips, on the other hand, a gasoline tax is a fairly progressive tax. In addition, since transit as a whole tends to be used more frequently by low-income people, the broadest argument for gas tax progressivity is that there is a transfer from automobile users to transit services in a general way. In this sense, a gasoline tax is progressive for all but the automobile dependent poor.

Administration
Administrative structure already exists and would need no major alteration to accept such a revenue measure.

Bridge, Tunnel and Highway Tolls – Bridge, tunnel and highway tolls would seem to be directly related to reducing traffic congestion but only 3 cities - New York, Philadelphia, and San Francisco - are currently using them partly to finance transit. There are implementation problems including legal obstacles related to how the revenue from tolls can be spent since generally, tolls are only directed to the maintenance and reduction of capital debt of the toll facility. Nevertheless, tolls are another method of inversely linking auto use and transit subsidies and as such, tolls are an appealing method to consider. In the Bay Area, the Metropolitan Transportation Commission is authorized to divert surplus toll revenue for transit capital projects and ferry operations.

Recently, there have been increases in the tolls charged on the Sumner-Callahan Tunnel, and the Massachusetts Turnpike. Tunnel tolls were increased from 60¢ (collected as a inbound one-way toll) to $1.00, and Mass Pike tolls were increased by an average of 30 percent.

Revenue
Total income from tolls depends on which facilities are effected and at what rates. Generally, however, the revenue from such a measure would be high. Even a small toll, such as a 50¢ toll on any major facility could net in the vicinity of $4.5 million per year.

Impacts
Tolls are a very direct method of controlling travel prices and thus, travel behavior. Typically, tolls work well when they can be placed equitably on all access points to a congested area. Furthermore, they have the potential to encourage more efficient travel patterns. While still rare nationally, differential toll structures could be used to favor high-occupancy vehicles, off-peak travellers, etc. As such, they present an interesting approach to highway pricing.

Generally, tolls can be justified on two grounds. First, transit supplies important movement capacity in both the Sumner/Callahan tunnel corridor (directly via the Blue Line) and in the case of the Tobin Bridge (less directly via the Orange Line). Thus, the auto user who pays the toll surcharge is directly benefitting from the transit service in the form of reduced travel times entering the city and reduced congestion. Secondly, existing transit services benefit tunnel and bridge users at their downtown destinations. Both of these benefits may be hard to visualize for travellers who use the already congested facilities, however, highway delays would be yet more severe if the transit services were not in place.

Administration
Administrative structure already exists and would need no major alteration to accept such a revenue measure. Legislative and legal changes would be required to permit a transfer of funding to support transit.

Parking Surcharges – Parking surcharges are a tax on parking fees. For these purposes, a parking tax is considered only on commuter parking in the downtown and not on residential or short-term parking. Since 1975, much of Downtown Boston (covering the area from Massachusetts Avenue to the Waterfront), Logan Airport and all of the City of Cambridge have been subject to a freeze on the number of commercial parking spaces. This parking freeze was developed by the Commonwealth as one part of a comprehensive strategy to reduce air pollution caused by automobile emissions, in order to achieve the air quality standards established by the Clean Air Act. The measures were seen as supportive of the Commonwealth's overall goals of limiting automobile travel to Logan Airport, downtown Boston and Cambridge to volumes within the capacity of the roadway system with public transit use absorbing the travel beyond that capacity. The freeze was included as one strategy in the Transportation Control Plan which was incorporated by

the U.S. Environmental Protection Agency in its federally promulgated plan for the Boston Region in 1975.

One of the unintended consequences of the parking freeze is that it has created something of a monopoly on commercial parking within the freeze zones and commercial parking operators have been able to benefit from windfall profits due to the lack of competition.

Revenues
The revenues available from parking taxes are estimated as follows:

1) Windfall profits tax on commercial parking in parking freeze areas at rates of 5 - 10 percent would generate between $10 and 15 million.

2) A $100/year parking permit fee on all employee and commercial parking spaces within parking freeze areas would generate approximately $5.8 million.

3) An all day parking fee surcharge (not to include residential parking) of 10 percent in the entire MBTA District would generate approximately $14 million.

Impacts
Downtown parking permit fees could create consistency in terms of the pressures which they bring to bear; i.e., they are payments for the use of scare downtown space and by further raising their cost a reduction in congestion might be realized by encouraging car pooling and transit use. When the parking freeze regulations were drafted, restrictions were placed on commercial parking while increases in employee parking were allowed to continue unrestricted. This inconsistency is expected to be addressed in the upcoming revision to the SIP and a similar addition might be made in taxing parking spaces in an effort to recoup some of the advantage that employee spaces have had for the last decade. For the purposes of this alternative, all commuter parking, employee and commercial is considered.

As a measure for linking the benefits of the measure and the fees incurred, and as a measure for discouraging traffic congestion, parking charges are potentially superior to taxes on motor vehicles and are equivalent to tolls. Little information is available on the effects of parking taxes on different income groups. In addition to raising revenue, parking taxes, generally have a mildly beneficial effect related to public transit and generally tend to encourage ridership.

The concept of a district-wide parking fee for all commuter (all-day, non-residential) parking could create consistency across the MBTA district. It

would create equal fees for both the motor vehicle-using commuter on Route 128 and the commuter driving into Boston. While these two commuters probably have very different transit options, they have similar impacts on the regional road network.

Administration
No administrative structure exists for collecting or allocating such fees, although each freeze area has an inventory of permitted spaces which has recently been updated. Establishing an administrative structure would be somewhat of a draw-back depending on which structure was adopted and would probably be an additional cost feature of this alternative. The least expensive ways to administer would be through a windfall parking tax for operators or through parking space permit processes at the City and town level.

Furthermore, one would expect resistance, on the part of parking lot operators. In San Francisco, for example, at a public hearing on such a measure, the following objections were raised:

(1) Parking taxes discriminate against drivers who are obliged to use commercial parking facilities.
(2) They place a financial burden on the parking industry.
(3) Had little effect on traffic coming into the city because only about 20 percent of the incoming vehicles used commercial parking facilities.

Special Roadway Use Charges/ Licensing Fees – A new approach to controlling roadway use in dense urban areas is the special licensing of certain roadways. Similar to a toll, users pay a fee to use a roadway but different from a toll, there is no need to stop each time the facility is used. One scheme currently used requires all drivers entering certain downtown zones to purchase and display a "downtown window sticker". The fees for such roadway use are then used for mass transit improvements. In some cases, these stickers are used to access shopping districts (for example, if a sticker were to be required for freight deliveries to Downtown Crossing). In other cases, such a sticker system could be used to deter unnecessary traffic from public facilities (ie., if a sticker were required for all traffic entering Logan Airport). Finally, in some cases, special permits are used to limit access on congested roadways during peak periods (ie. if a sticker were to be needed in order to use Boylston Street between 7:30 a.m. to 9:30 a.m. and 4 p.m. to 6 p.m.). This last scheme is in its first year of testing in Stockholm, Sweden in an effort to reduce traffic congestion. The strategy being implemented includes a hefty annual price increase for the window stickers to test price elasticity. The price increases are planned until price becomes a deterrent to using motor vehicles as the mode of choice into the downtown. In order not to have negative effects on downtown economic activity, this strategy also requires adequate fringe parking facilities and good public transit.

An alternate method of licensing roadway use and controlling access relies on an innovative technology of electronic sensors imbedded in the roadway which record the distance travelled on downtown streets on a type of odometer. Like a taxi meter, the odometer is read every so often and a fee is assessed. This scheme is currently being implemented in Singapore, the first major city to develop such a plan. The system is still being developed and little literature is yet available on its status.

Revenue
The potential revenue for such a plan is very difficult to estimate at the present time.

Impacts
The impacts of such a system depend largely on practical matters such as the cost of the permit, the ease with which it could be obtained, the ability to accommodate tourists and temporary travellers, the ability of the implementing authority to ticket violators by mail and the area and conditions of the permitting. Under a most draconian scenario, special roadway use permits could have adverse effects on the economy of the area in which it is implemented. Under a well-conceived plan, a special roadway use fee could be preferable to existing tolls on public facilities with an advantage of reducing delays, reducing the air pollution of idling and eliminating the inconvenience of needing to have coins available.

Administration
Special licensing districts would need to be established, primarily in the most dense areas of the region, such as Downtown Boston and Cambridge. The allocation of licenses to residents could operate similar to the current residential parking sticker programs. Roadway licensing would challenge many people's view of access to public facilities. Most likely, none such permits could be used on facilities which were federally-funded and undoubtedly much legal research would be needed to determine the implementing agency's authority in such matters. Minimally, new legislation would likely be needed.

General Revenue Sources

Sales Tax – Nationally, sales taxes are the most popular local taxes for subsidizing transit, with 12 of the country's 26 largest metropolitan areas using it to complement their federal subsidies. In some districts, the transit district itself has direct taxing authority and in others, city, county or regional government collects the taxes. San Francisco, for example, has used sales taxes in the funding of the BART system.

Revenue

Sales taxes have a high potential yield and will usually keep pace with inflation. They are, however, an erratic source of income. This is because they have a base of items which are generally discretionary purchases (restaurant meals, automobiles and consumer durables). In slow economic times, such purchases will be delayed or foregone and more essential items such as food and non-luxury clothing are exempt from the tax. According to a study done in 1987, a one percent increase in the tax would bring in $185 million annually to the MBTA district.[49] The same study found that state-wide a 1 percent sales tax would generate almost $375 million. Another recent study prepared for the MBTA Advisory Board[50] found such a sales tax capable of generating in excess of $160 million if initiated within the MBTA district.

Impacts

Estimates of the effect of tax rates on different groups indicate that sales taxes and excise taxes are relatively proportional forms of taxation. Furthermore, in four public opinion polls reviewed, sales taxes have been shown to be more acceptable than real estate, motor vehicle and payroll taxes. This is probably because sales taxes are not presented as a lump sum fee but are dispersed gradually over the course of the year in each purchase and add only marginally to the cost of each purchase.

In Atlanta, a one percent sales tax and use tax was levied in two counties to allow fare stabilization. Sales tax and fare revenue were applied to meet development and operating costs. The immediate result was a 30 percent increase in ridership. A survey conducted 10 months after the decrease in fares, showed 91 percent of the increase was due to new riders and 41.8 percent of the new riders previously made the same trip by automobile.[51] The Atlanta study also reported the sales tax was regressive, but pointed out that consideration had not yet been given to the "compensating effect" of the low fare. Massachusetts has slightly enhanced the progressivity of sales tax by exempting certain items, notably food and clothing (under $175), considered essential items. In many other states, sales taxes apply to clothing and to many food products. Also, Massachusetts has exempted certain personal service industries such as dry cleaning and hair dressing from sales taxes.

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[49] Dr. James H. Wooster, Local Non-property Taxation: An Option for Massachusetts Cities and Towns?, March 31, 1987.

[50] Karen Dacey, Financing MBTA Operating Costs, MBTA Advisory Board, Future MBTA Service and Funding Alternatives, Vol. II, January 1989.

[51] William C. Nevel, "Case Studies in Increasing Transit Revenues: Northeastern Illinois," Urban Transportation Economics, Spring 1978.

The problem with a sales tax, in addition to its tendency towards regressivity, is that has a slightly depressing effect on regional sales as it may encourage shoppers to go beyond District or State borders to buy goods. The sales tax, also, is not directly tied to the transit problem as is, say, a tax on parking or gasoline.

An additional form of sales tax is selective so called "sin" sales taxes on products such as liquor or tobacco (Massachusetts used to collect 2 cents per cigarette pack for transit funding). Although these goods are already heavily taxed, according to the Advisory Board study, they provide relatively stable income flows.

Administration
A State-wide sales tax is relatively simple to administer since a general structure already exists, however, the implementation of a new sales tax involves a great deal of preparation and would take a number of months to institute. Currently, the sales tax in Massachusetts is state-wide and a district-wide one would likely be a difficult one to administer. Large state-wide businesses would need to break-down their sales by stores to identify the in-district sales outlets. This would require preparation on behalf of the Department of Revenue. It would also have some negative effects in competitive advantage for taxed areas. A more sensible approach might be to create a dedicated transit tax which would apply state-wide to each of the various transit authorities state-wide.

Dedicated MBTA Property Taxes

Real Estate Property Taxes – The MBTA currently receives local property taxes through local assessments. These are charged to each town in the MBTA District according to an assessment formula based, in part, upon the level of service which each town receives. This option, however, considers an additional earmarked tax authorized by the state legislature to go directly to the MBTA.

Property taxes are assessed by city and town governments and in Massachusetts they supply virtually all locally-generated tax revenues. The property tax is an ad valorem tax where the base is the assessed value of the property land and buildings (or other improvements) subject to tax. The property tax is especially vulnerable to local opposition and though, other taxes have risen more, taxpayers have more local control over local governments than over state and federal taxes. The largest tax revolt in Massachusetts (since the Boston Tea party) occurred with the passage of Proposition $2^{1/2}$. Massachusetts Proposition $2^{1/2}$ created a 2.5 percent per year limit on taxes. This rate is far below the rate in inflation and this has meant that the real value of tax revenues has not kept pace with inflation.

Two types of property taxes could be levied; on residential property or on commercial/industrial property. The benefits of transit service to property in an area depend on how much transit is used and whether it stimulates economic activity. In the Boston area, we have seen that transit development does increase adjacent investment greatly but not evenly through-out the system. For example, new transit in Davis and Porter Squares has spurred significant new economic activity, while similar new access in the Stony Brook section of Jamaica Plain has been accompanied by increases in housing prices but far less new economic activity. Both neighborhoods have clearly seen major gains in both residential and commercial real estate values.

Revenue
As with income taxes and sales taxes, property taxes are broad-based and small rate increases have high revenue potential. The amount of revenue generated would be dependent upon the tax rate.

Impacts
Ad Valorem real estate taxes (ones which are based on the value of the land and buildings, etc. rather than the amount of land) have an effect of discouraging construction and rehabilitation of properties because they create a cost of the improvements. A transit-dedicated property tax would compete with the communities' ability to raise additional revenue from the same source. In urban areas with active real estate markets, the effects of these additional costs are usually not very significant and the rising values of real estate will tend to soften the tax impacts. Where economic development is slow and where real estate activity is soft, property taxes may have a larger negative effect. However, property taxes are mildly progressive and in many states, are accompanied by property tax relief to low-income families. In some cases low-income housing is completely exempted from tax surcharges. For higher-income residents, property tax burdens are eased a bit by the fact that they are deductible from other state and federal tax bills. The greatest burden is generally felt by the middle-income householder. There are no expected impacts on transit or auto ridership.

Administration
This type of tax would be very easy to administer, however, with Proposition $2^{1/2}$ in effect, it is unlikely that an additional property tax of any type would be passed by the Massachusetts State Legislature.

Betterment Assessments – This is a fee levied on all landowners within a designated district to help pay for capital improvements that benefit their property. The fees may be paid as a lump sum payment or they may be collected yearly as part of an overall tax bill. In either case, the assessment cannot be collected until the improvement is in place. This concept has some limited application in the MBTA district, primarily where new development

is taking place. Using the betterment district concept to finance existing facilities would be more difficult.

Value Capture Techniques – This category covers a number of types of financing techniques which are designed to share the benefits of public investment in transit services as a way of funding their operation. Public investments, such as transit stations and service improvements improve access and raise land values. In addition, they often allow for higher density development than would be possible if roadway access (and parking for all employees/users) needed to be included in the development. Although public improvements do not produce uniform impacts of neighborhoods, generally values tend to rise at new rail stations and taper off with increased distance from them. The general concept of value capture financing is that those who benefit from the betterments through increases in the value of their property should help to finance the public costs through taxes on the value increases.

In one example, the MBTA has studied such a system extensively for the funding of a potential South Boston/Fan Piers Area transit service. The concept of special assessments is not new. Such districts were used extensively in the early 1920's but fell into disfavor during the "Great Depression" when because developers were unable to sell their properties and defaulted on the special assessment bonds.

Generally, this method is employed in a different form by the MBTA and by the City of Boston and to a less extent by other cities. Developers in these areas may be required to provide public amenities or facilities as a measure of reducing the negative impacts of their project on the community. They may be asked to construct transportation facilities and while these "extractions" tend to be locally used, occasionally they benefit a larger audience. For example, the Rowes Wharf development created public ferry boat dockage as a condition to being able to use public water access. While not a formal assessment district measure, in essence, this has been an arranged private assessment for the use of the waterfront and it has benefitted the water transit system as well.

Revenue

The revenues from special assessment districts can not be accurately determined at this time but represent a viable form of special revenue.

Impacts

Such an approach is highly equitable in the sense that those who benefit from new transit share some of that benefit. To be fully equitable, value added techniques need to be employed not just in areas with new transit services but in all areas served by transit services, although this may pose a myriad of legal problems.

Administration
Betterment districts are not especially difficult to implement. Various arrangements could be made for the collection of special assessments either as lump sum payments at the beginning of the project or as installment payments.

Private Financing or Public/ Private Transit Partnerships – Private financing of transit improvements is becoming increasingly common throughout the United States. There are many examples of places where major improvements, usually capital improvements, have been made either completely or partially by a private venture which stood to benefit from the service. The MBTA is in an active position of exploring a variety of private funding mechanisms to finance capital projects and to defray the operating costs of new service. For example, the MBTA is studying public/private financing alternatives for the development of a transit service to the South Boston Piers development area. A proposal receiving much interest is that of using garnering 25% Federal, 25% State, 25% local and 25% private funding for the project. Such partnerships might also be considered as future measures for funding the operating costs of existing services.

Revenue
Predicting revenue for these partnerships are hard to forecast since they tend to be related to individual projects.

Impacts
These types of financing partnership tend to fund capital improvements and rarely assist in funding operations. They do not, generally have any negative impacts on equity and they tend to draw private corporate funds which do not create regressive taxation conditions.

Administration
The administration of such partnerships tend to be unique and not costly per se.

Dedicated MBTA Income-Based Taxes

Income and Payroll Taxes – Taxes can be imposed either directly on the employees or the employer. If paid by the employer, the tax becomes a direct overhead cost of doing business and could be deducted as a business expense, and will generally reduce other state and federal taxes collected. Typically, under these taxes, small firms and the self-employed are not taxed. The greatest objection to these taxes is that they are already used heavily for retirement, social security, and workmen's compensation and that additional taxes tend to place the firms within the district at a slight competitive disadvantage. Such taxes also discourage the location of new firms, although

some of this effect is a psychological one rather than a financial one. The payroll tax could also be used as an incentive for employers to provide employer-organized ridesharing programs or transit-discount programs. In such cases employer taxes could be reduced or eliminated. Employer provided or subsidized housing within walking distance could also be eligible for tax waivers.

Revenue
The potential yield from payroll taxes is high for even a small percentage tax. As with a sales tax, it is somewhat tied to inflation. According to the Department of Revenue, the estimated revenue gain for the district would be $200 million annually with only a one half percent increase.

Impacts
The equity for employers may not be clear-cut depending on the type of business, since some types of business can not benefit from transit access for their employees. However many employers benefit from transit services because their access to a varied labor force is expanded. Statewide, 60 percent of the total payroll earned in the state is inside the MBTA District. In addition, payroll taxes are considered to be slightly regressive taxes since wealthier people tend, on average, to have a larger percentage of income which is not derived from their direct salaries (i.e., investments - capital gains income, interest income, etc.).

Administration
Employers already pay several forms of employer taxes such as social security withholdings, workmen's compensation and unemployment compensation, so, in effect the system is already in place. There are some jurisdictional questions of companies headquartered inside the MBTA district and doing much of their income-generating business by employees outside of the District. Administration is not seen as an exceedingly difficult task.

COMPOSITE PACKAGES: PUTTING TOGETHER A FINANCIAL PLAN FOR TRANSIT

For the public good and the stability of public transit in this region, the MBTA needs to look towards developing a more balanced "portfolio" of financing measures, which would be able to survive a variety of economic conditions. For example, having some measures that would withstand times of inflation, some that would continue to grow even if gasoline prices climbed, some that would continue to be stable in time of economic hardship, etc. will as a whole serve the MBTA and the public best over the long run.

There are a few transit systems which employ this balanced approach. In the Chicago area, a composite system has been proposed for the Regional Transit Authority (RTA) which includes revenue from the sales tax, a $14 excise tax for vehicle registration, a 5 percent added sales tax on motor fuel, and an all-day (commuter) parking tax. Experimentation with a combination of the above mentioned taxes might work more effectively to create a good blend of incentives and disincentives for meeting public goals.

The impacts of composite taxes are varied depending on the measures chosen. Overall, composite packages offer the possibility of balancing various potential impacts such as ridership loss, progressivity and long-term stability. It is recommended that the MBTA look to assembling such programs and that a special legislative review is made of these proposals.

10. Revenue Recovery Issues

MBTA OPERATING COSTS AND EXISTING FUNDING

MBTA operating costs have been increasing due to three factors: inflation, service expansion, and increased long term debt (for capital projects) that is repaid as part of the operating budget. These three factors combined have increased total MBTA operating costs by an average of 7.2 percent between CY 1983 and FY 1989. The MBTA has taken many actions to minimize costs and to improve productivity. As a result, when measured on a cost per revenue mile basis in constant dollars, operating costs have been declining since FY 1982.

The most significant of the measures to improve productivity was the implementation of the management rights act legislation by the State Legislature in 1980. This enabled the MBTA to make efficient use of part-time workers, to contract out for services, and to strengthen control of labor costs. Estimated savings through management rights initiatives are estimated at $15 million per year. The MBTA also has a number of other ongoing cost control programs. For FY 1991, these include:

- Staff Reduction – Administrative budgets have been cut back and the MBTA has begun to reduce administrative staff. By the end of FY 1991, the MBTA expects to reduce administrative staff by 15 percent below originally projected FY 1990 levels. In total, the MBTA expects to employ 100 fewer personnel than it did in FY 1988.
- Overtime – The Authority capped overtime usage in FY 1990 at a level 20 percent below FY 1988 and five percent below FY 1989. Through the first eight months of FY 1990, total overtime hours were 25 percent below the prior year and nearly 40 percent below FY 1988.
- Scheduling Efficiencies – The Authority will implement additional management rights provisions in FY 1990 that will result in a more efficient use of labor in providing transportation services.
- Pension Savings - Last year the Authority renegotiated a new pension rate with its unions that saved $1.5 million.
- Health Insurance – The MBTA is auditing previous health insurance bills to identify those which should not have been paid and to recapture the money. While the MBTA's health insurance costs are expected to grow

by 10 percent this year, this is significantly below the 15 to 20 percent growth rate expected by the industry.

- Workers Compensation – The MBTA is proceeding with greater use of "light duty" positions for injured employees, a proposed agreement with the Department of Revenue to match worker' compensation claims against their wage reporting files, and legislation that will prevent employees from simultaneously collecting both worker's compensation and a pension. While workers' compensation costs will continue to increase, the rate of growth will slow.
- Travel, Subscriptions, Telephone, Insurance – The MBTA has placed greater controls on out-of-state travel, subscriptions, outside printing, long distance telephone calls, and excess public liability insurance.

In addition, the MBTA is also pursuing a number of legislative initiatives that would result in reduced costs:

- Tort Liability – The State and all 351 of its communities are protected by a $100,000 liability cap on tort claims. By contrast, the MBTA has unlimited tort claim exposure. Granting the MBTA the same limitation on liability as that of the State and its cities and towns would eventually produce savings estimated at $4 million to $5 million per year in reduced payments to claimants in judgments or settlements. In addition, insurance expenses could be cut by approximately $1 million per year.
- Workers' Compensation – Significant additional reform of worker's compensation laws could stem the double-digit growth in this expense category. This is an issue faced not only by the MBTA but also by all major employers in the Commonwealth.
- Revenue Bonds – Enactment of the authority to issue revenue bonds to allow appropriate capital projects to be self-financing, thereby reducing reliance in state debt assistance.
- Power Costs – The MBTA has proposed legislation that would authorize it to join NEPOOL, the New England consortium of electric power utilities. As a member of NEPOOL, the MBTA could shop for the lowest electric rates and save $2.1 - $3.2 million annually.
- Parking Enforcement – Legislation has been proposed to provide MBTA police with the power to enforce parking regulations on MBTA property. This will permit the maximization of revenues from MBTA parking lots.

One important reason the MBTA has reduced per-mile costs and limited its spending growth to a lower rate than the overall increases in State spending is the extensive budgetary oversight to which the MBTA is subject. Before the MBTA can spend operating funds, its budget must be approved by both the Governor (through the Board of Directors) and the MBTA Advisory Board. Furthermore, capital spending is subject to additional approvals by the Governor (through the Secretary of Transportation and Construction and the Secretary of Administration and Finance), and by the Legislature through

control of the size and timing of the Commonwealth's periodic Transportation Bond bills. This budget process includes consideration of operating practices, as well as fare and service levels.

With a 33 1/3 percent revenue recovery ratio, the MBTA will work to reduce the frequency and magnitude of fare increases by continuing to improve the system to increase ridership and by continuing to increase other operating revenue (such as concession and joint development revenues, etc.). At the same time, given human limitations, contractual and legal constraints, and the dynamics of technology and operational procedures, there is always room for improvement. Therefore, through day-to-day management decisions, and through the budget review process, the MBTA will also continue to strive to operate as efficiently as possible and to continue to identify actions to increase its operating efficiency, thereby reducing costs. However, at some point, even with increasing ridership and more efficient operations, there will be a need to increase fare revenue and/or to reduce operating costs to meet the 33 1/3 requirement.

Efficiency measures implemented to date, while important, have not been sufficient to make up for the reductions and/or limitations in local and federal funding – since 1983, federal funding has been reduced and local assistance has increased only 2.5 percent per year. To offset these losses, state funding has had to be increased to fund the difference. As shown in Figure 10-1, State funding for operating subsidies and debt service has increased from $150.2 million in CY 1983 to a projected $348.8 million for FY 1990, resulting in annual increases averaging 12.8 percent per year.

These trends are even clearer after accounting for the impact of inflation. When measured in constant 1983 dollars, the value of both federal subsidies and local assistance has decreased. Between 1983 and 1990, the value of federal operating assistance has decreased 32.9 percent from $21.3 million to $14.3 million. The value of local assistance over the same time period has decreased 10.8 percent from $99.8 million to $89.0 million.

To cover these funding reductions, service expansion, and increased debt service, state funding, in 1983 dollars, has been increased 21 percent (see Figure 10-2). In effect, since the passage of Proposition 2 1/2 in 1981, state costs have increased rapidly because the State has borne 100 percent of the costs for all MBTA service expansion, the local share of capital projects, and all inflationary increases in excess of 2.5 percent.

During the same period, fare levels had remained constant, so that increases in revenue until this fare increase had been limited to increases in ridership and non-fare revenue (as described previously in this chapter). Because ridership has been increasing, fare revenue, including commuter rail

Figure 10-1
MBTA Subsidy Costs in Current Dollars

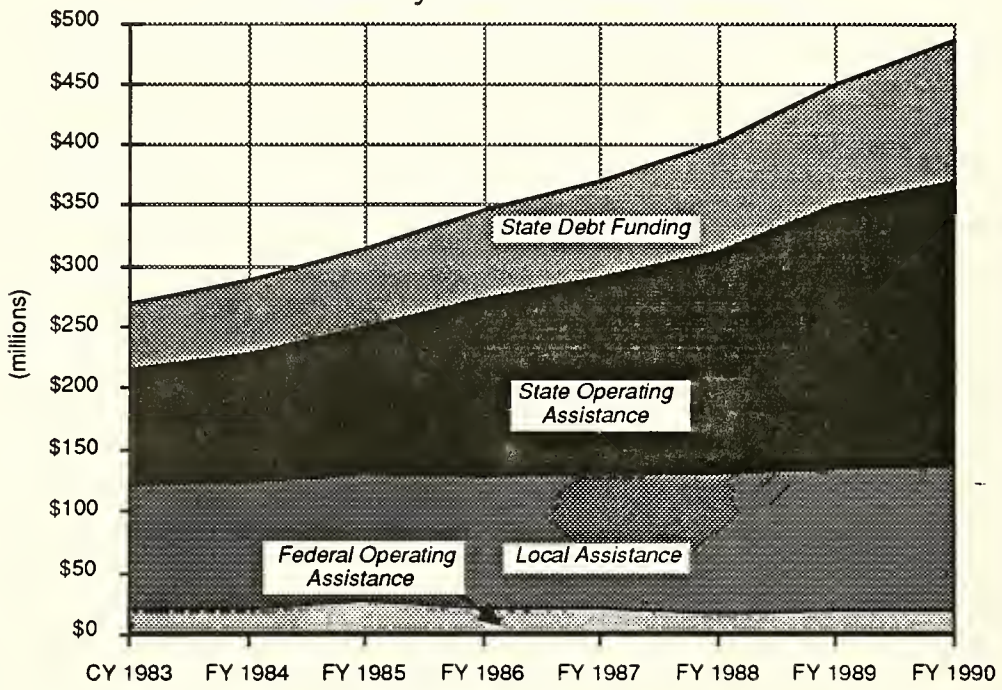
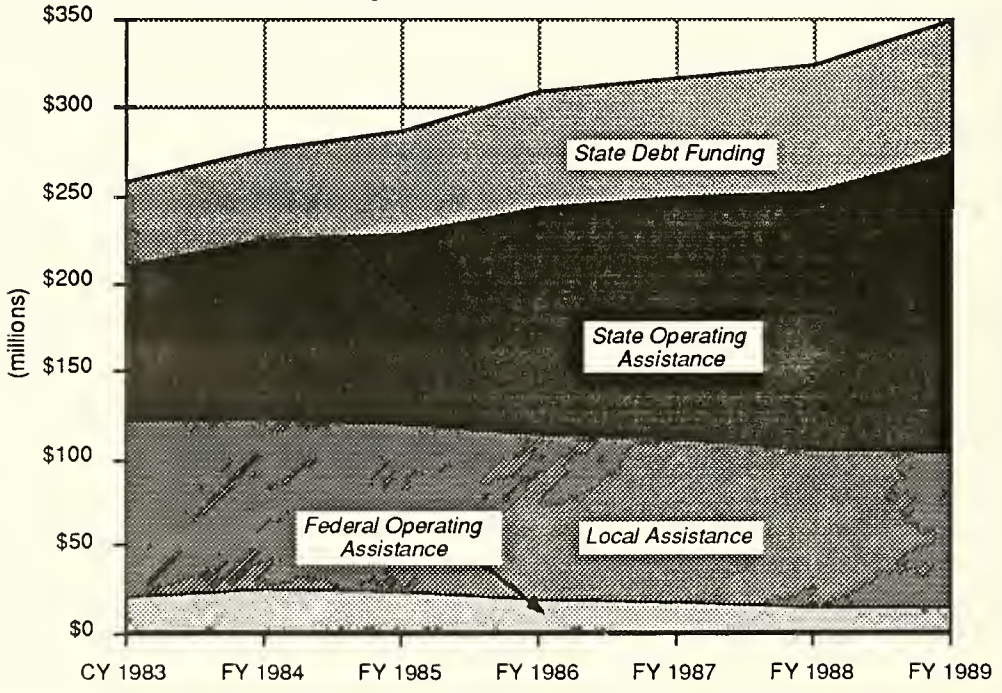


Figure 10-2
MBTA Subsidy Costs in Constant 1983 Dollars



revenue, has increased each year, at an average rate of 4.6 percent between CY 1983 and FY 1989. Total revenue, which includes non-fare revenue, has increased at an average rate of 4.0 percent. However, since revenue has increased at a lower rate than expenses, the operating deficit has increased and the revenue recovery has decreased.

For FY 1990, the MBTA has an operating budget of $663.1 million, which represents a 9.8 percent increase over FY 1989's budget of $603.8 million.[52] This budget represents expenditures in two basic areas: (1) operation of the system, including the maintenance of equipment and physical plant and (2) debt service to repay bond revenues used for capital expenses, such as vehicle acquisition and infrastructure improvements.

Depending upon how the revenue recovery ratio is calculated, the projected ratio for FY 1990 will be between 27 and 32 percent (see Table 10-1). It would be 32 percent for all modes if interest income and debt service are not included in the calculation, or 27 percent if they are. Although interest income and debt is included in the MBTA's operating budget, they are actually related to capital projects, and not a part of operations. Excluding debt service from revenue return calculations on this basis, resulting revenue return ratios between 1983 and 1990 are shown in Figure 10-3.

As shown in this figure, the revenue recovery ratio for all all modes combined had been generally declining until the Spring 1989 fare increase – from nearly 35 percent in CY 1983 to 30 percent in FY 1989. The fare increase, when originally implemented, was intended to increase the overall revenue return ratio from approximately 30 percent in FY 1989 to 33 percent in FY 1990. However, due to a jump in costs resulting from an unexpected Local 589 arbitration award, and more recent ridership estimates, the FY 1989 revenue ratio is now estimated at 32 percent.

THE MBTA ADVISORY BOARD'S 33 PERCENT REVENUE (FAREBOX) RECOVERY RATIO POLICY

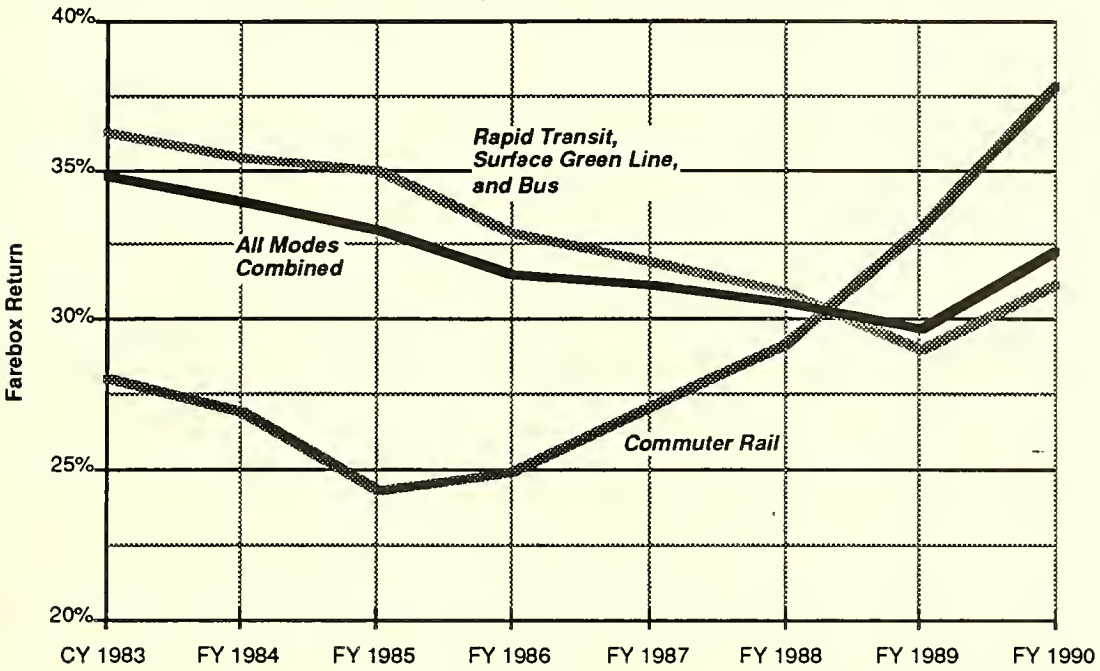
Since 1984, the MBTA Advisory Board has proposed a policy that fare revenue should cover a minimum of 33 percent of operating expenses. The Advisory Board believes that a minimum revenue recovery ratio will keep

[52]Budget figures are presented in this section in a different manner than in budget documents. MBTA budgets include only the net cost of commuter rail service (i.e., operating costs minus the revenue collected by Amtrak). Since this section deals with farebox revenue, budgets presented herein include the total cost of commuter rail service and all commuter rail fare revenue.

Table 10-1
Operating Budgets, Subsidy Levels and Revenue Recovery Ratios: 1983 - 1990
(All figures in 000s)

	CY 1983 Actual	FY 1984 Actual	FY 1985 Actual	FY 1986 Actual	FY 1987 Actual	FY 1988 Actual	FY 1989 Estimated	FY 1990 Budget
Operating Costs								
Basic System	$276,616	$289,193	$312,182	$339,932	$358,142	$386,003	$420,397	$450,258
Commuter Rail	$60,068	$62,558	$69,043	$70,580	$74,383	$80,753	$78,421	$88,553
Total	$336,684	$351,751	$381,225	$410,512	$432,525	$466,756	$498,818	$538,811
Debt Service	$59,675	$63,786	$68,486	$77,861	$83,263	$92,071	$104,939	$124,329
Total Operating Expenses	$396,359	$415,537	$449,711	$488,373	$515,788	$558,827	$603,757	$663,140
Fare Revenue								
Bus & Rapid Transit	$94,940	$97,499	$103,190	$104,814	$108,610	$112,214	$114,533	$128,100
Commuter Rail	$16,841	$16,814	$16,782	$17,594	$20,123	$23,544	$27,882	$33,500
Total	$111,781	$114,313	$119,972	$122,408	$128,733	$135,758	$142,415	$161,600
Other Operating Revenue	$5,543	$5,109	$5,934	$7,206	$5,968	$7,210	$7,297	$12,174
Interest Income	$7,689	$7,458	$8,300	$11,227	$9,386	$12,617	$5,388	$3,068
Total Revenue	$125,013	$126,880	$134,206	$140,841	$144,087	$155,585	$155,100	$176,842
Cost in Excess of Income	$271,346	$288,657	$315,505	$347,532	$371,701	$403,242	$448,657	$486,298
Subsidies								
State Debt Funding	$55,217	$59,333	$65,257	$73,951	$79,554	$89,713	$98,650	$116,131
UMTA Section 9	$21,338	$21,338	$26,489	$20,879	$20,607	$17,942	$18,640	$18,810
Local Assistance	$99,809	$102,305	$104,862	$107,484	$110,171	$112,925	$115,748	$118,642
State Operating Assistance	$94,982	$105,681	$118,897	$145,218	$161,369	$182,662	$215,619	$232,715
Total Subsidies	$271,346	$288,657	$315,505	$347,532	$371,701	$403,242	$448,657	$486,298
Revenue Recovery Ratios								
(Excluding Interest Income and Debt Service)								
Bus & Rapid Transit	36.3%	35.5%	35.0%	33.0%	32.0%	30.9%	29.0%	31.2%
Commuter Rail	28.0%	26.9%	24.3%	24.9%	27.1%	29.2%	35.6%	37.8%
All Modes	34.8%	34.0%	33.0%	31.6%	31.1%	30.6%	30.0%	32.3%
(Including Interest Income and Debt Service								
All Modes	31.5%	30.5%	29.8%	28.8%	27.9%	27.8%	25.7%	26.7%

Figure 10-3
Revenue Recovery Ratios - CY 1983 to FY 1990



pressure on the MBTA to run an efficient, cost-effective service and to increase productivity. The Advisory Board also believes that "modest, reasonably timed fare increases are in the long run in the best interest of public transit and of regular riders." For FY 1990, the Advisory Board resolved that the MBTA "develop and implement by July 1, 1989 a comprehensive plan to balance income and expenses so as to maintain a 33 percent fare recovery ratio in FY90."

The 1989 fare increase was a result, in large part, of this policy, and as stated above, was originally intended to achieve a 33 percent fare recovery ratio. At the same time, while the MBTA recognizes that fare revenue is one measure of the cost-effectiveness of transit service, it also believes fares should be set at levels intended to provide a balance between the conflicting goals of maximizing ridership and maximizing revenue. Between 1983 and 1989, the emphasis had been on upgrading the system and attracting new riders. During that period, the absence of a fixed revenue return requirement provided flexibility to make expenditures to increase ridership and to upgrade the system. Now, due to state budget problems, the emphasis has shifted towards increasing revenue and reducing the operating deficit. However, once the State's budget problems are solved, and depending upon other

economic and growth factors, maximizing ridership could again take higher priority.

RIDERSHIP AND REVENUE IMPACTS OF A 33 PERCENT REVENUE RECOVERY REQUIREMENT

To maintain a constant or minimum revenue return ratio, revenue must increase at the same rate as expenditures over time. To achieve this without raising fares would require larger increase in non-fare revenue,[53] ridership growth in excess of that now occurring, and/or reduced expenditures.

As discussed earlier in this chapter, the MBTA is currently exploring a number of ways to increase non-fare revenue, but all of the potential sources are expected to result in moderate revenue increases over the short-term. Further, the MBTA, in addition to service improvements over the past few years, has recently increased its marketing efforts to attract new ridership. However, short of implementing new services, which would also result in higher costs, large increases in ridership beyond those already projected cannot reasonably be expected. As previously mentioned, the MBTA will continue to explore additional ways to increase non-fare revenue, attract new ridership and to improve productivity further. However, even with these actions, it will still be necessary to either increase fares or cut service to meet the 33$^{1}/_{3}$ percent revenue recovery ratio. Although the MBTA recently implemented some bus service reductions to reduce costs, over the long term, the MBTA plans to continue to improve and expand service to attract new riders. Therefore, to analyze the impacts a 33 percent revenue recovery requirement, it is assumed that fare levels would be increased rather than service levels cut.

The MBTA Advisory Board's policy calls for a *minimum* 33 percent revenue recovery ratio. To keep fares as low as possible with this requirement would necessitate frequent fare increases. However, to reduce the amount of disruption that fare increases can sometimes cause, the MBTA Advisory Board would prefer that increases be implemented on a less frequent basis (every three to five years) . Since expenditures are expected to increase faster than ridership, this would require that fares be set at levels that would initially produce revenue return ratios higher than 33 percent, which would decline slightly each year until it hit 33 percent in the last year before the next fare increase. As a result, although periodic increases may be less disruptive on a year-to-year basis, they would result in higher fares than annual increases. This, in turn, would result in lower ridership, but also a reduced operating deficit.

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[53]Which is counted as "fare revenue" for the purposes of calculating farebox return ratios.

The analysis presented below examines both frequent and periodic fare increases in terms of their impact on fare levels, MBTA ridership, the operating deficit, state subsidies, and the tax burden on Massachusetts residents within and outside of the MBTA district. Both options are also presented in comparison with the impacts of holding fares at present levels.

For the purposes of this analysis, future operating costs and other expenses, as shown in Table 10-2, are based on MBTA projections. These assume that planned service expansion will occur and that operating costs will increase over the next five years at an average rate of six percent, ridership will

How the Revenue (Farebox) Recovery Ratio is Calculated

The revenue recovery ratio used in this analysis is based on the commonly used definition that divides operating revenue by operating costs. Although commonly referred to as "farebox" or "fare" recovery ratio, it includes all revenue generated as a result of operations – fares, parking fee revenues, concession and advertising revenues, etc. However, operating revenues, do not include income that is not generated as a result of operations, such as interest income earned through the investment of capital funds.

Operating costs include all costs of operating and maintaining the system, but do not include the cost to construct or perform major reconstruction of the system or to purchase new rolling stock. Also excluded from operating costs are the costs for debt service incurred for capital projects.

The revenue return ratio calculated herein also includes commuter rail revenue collected by Amtrak and the full cost of commuter rail service, not just the subsidy cost. Based on the contract between the MBTA and Amtrak, Amtrak retains all of t he commuter rail revenue it collects, and then the MBTA pays Amtrak the difference between total contract costs and amount of revenue collected by Amtrak. This amount appears in MBTA budgets as "Commuter Rail Subsidy." When calculating revenue return ratios, the full cost of commuter rail service is included in operating costs (which is calculated by adding the commuter rail subsidy costs to commuter rail revenue figures), and the amount of commuter rail revenue collected by Amtrak is included as operating revenue.

Note that this ratio is different from the MBTA Advisory Board's recovery ratio which only includes fare revenue, and not other operating revenue. The Advisory Board's ratio also differs in that it excludes commuter rail costs and revenues, and costs for other subsidized services.

Lastly, subsequent to completion of this analysis, legislation was enacted (MGL, Chapter 653, Section 199) requiring the MBTA to achieve a 33 1/3 percent recovery ratio. The ratio included in the legislation includes fare revenue and all other operating revenue, as well as UMTA Section 9 operating assistance. On the cost side, the state requirement excludes debt service and private carrier subsidies. The MBTA is now in the process of determining the impacts of this legislation and is preparing a report detailing how the requirement will be met.

Table 10-2
Projected Budgets and Revenue Recovery Ratios with Constant Fares: 1989 - 1996
(All figures in 000s)

	FY 1989 Estimated	FY 1990 Budget	FY 1991 Budget	FY 1992 Projected	FY 1993 Projected	FY 1994 Projected	FY 1995 Projected	FY 1996 Projected
Operating Costs								
Basic System	$420,397	$450,258	$481,836	$510,746	$541,391	$573,874	$608,307	$644,805
Commuter Rail	$84,133	$88,553	$93,230	$98,824	$104,753	$111,038	$117,701	$124,763
Total	$504,530	$542,695	$575,066	$609,570	$646,144	$684,913	$726,008	$769,568
Fare Revenue								
Bus & Rapid Transit	$114,533	$128,100	$130,700	$135,275	$140,009	$144,909	$149,981	$155,231
Commuter Rail	$27,882	$33,500	$36,086	$37,349	$38,656	$40,009	$41,410	$42,859
Total	$142,415	$161,300	$166,786	$172,624	$178,665	$184,919	$191,391	$198,089
Other Revenue	$7,297	$12,174	$12,242	$12,854	$13,497	$14,172	$14,880	$15,624
Total Revenue	$149,712	$173,474	$179,028	$185,478	$192,162	$199,090	$206,271	$213,714
Cost in Excess of Income	$354,818	$369,221	$396,038	$424,092	$453,982	$485,823	$519,737	$555,854
Subsidies								
UMTA Section 9	$18,640	$18,810	$18,810	$18,810	$18,810	$18,810	$18,810	$18,810
Local Assistance	$115,748	$118,642	$121,608	$124,648	$127,764	$130,959	$134,233	$137,588
State Operating Assistanc	$220,430	$231,769	$255,620	$280,634	$307,408	$336,054	$366,694	$399,456
Total Subsidies	$354,818	$369,221	$396,038	$424,092	$453,982	$485,823	$519,737	$555,854
Revenue Recovery Ratio (Excluding Debt Service)								
Bus & Rapid Transit	29.0%	31.2%	29.7%	29.0%	28.4%	27.7%	27.1%	26.5%
Commuter Rail	33.1%	37.8%	38.7%	37.8%	36.9%	36.0%	35.2%	34.4%
All Modes	29.7%	32.0%	31.1%	30.4%	29.7%	29.1%	28.4%	27.8%
Annual Ridership								
Bus & Rapid Transit	255,201	264,100	269,382	278,810	288,569	298,669	309,122	319,941
Commuter Rail	18,621	19,100	20,100	20,804	21,532	22,285	23,065	23,872
Total Ridership	273,822	283,200	289,482	299,614	310,100	320,954	332,187	343,814
Rapid Transit Fares								
Adult Cash	60¢	75¢	75¢	75¢	75¢	75¢	75¢	75¢
Adult Monthly Pass	$22	$27	$27	$27	$27	$27	$27	$27
Child/Student	30¢	35¢	35¢	35¢	35¢	35¢	35¢	35¢
Bus Fares								
Adult Cash	50¢	50¢	50¢	50¢	50¢	50¢	50¢	50¢
Adult Monthly Pass	$18	$18	$18	$18	$18	$18	$18	$18
Child/Student	25¢	25¢	25¢	25¢	25¢	25¢	25¢	25¢
E&H (RT & Bus) Fares	10¢	10¢	10¢	10¢	10¢	10¢	10¢	10¢
Commuter Rail Fares								
Cash & Pass Increase		+24%	0%	0%	0%	0%	0%	0%

increase at an average rate of 3.5 percent, and that non-fare revenue will increase at five percent. Interest income and the cost of debt service (which is projected to increase at an average rate of 15 percent per year) is not included. On this basis, the MBTA's operating budget is projected to increase from $542.7 million in FY 1990 to $769.6 million in FY 1996. As also shown in Table 10-2, with stable fare levels, operating revenue would increase over the same period from $173.5 million to $213.5 million. The operating deficit would increase from $369.2 million to $555.8 million.

Based on these projections, the revenue recovery ratio would fall from 32 percent in FY 1990 to 28 percent in FY 1996. To meet a 33 percent revenue return ratio, revenue would need to be increased by approximately $10.8 million in FY 1991 and $40.3 million by FY 1996. As shown in Table 10-3, this would require that revenue increase an additional 6.0 percent in FY 1991 and 18.9 percent in FY 1996. For FY 1991, because the revenue return ratio is now below 33 percent, revenue would need to be increased by $10.8 million. Once a 33 percent revenue ratio had been achieved, required increases in revenue range from $4.9 to $6.9 million per year. If all of the additional revenue were to be generated from fare increases, a seven percent increase would be required for FY 1991. After the 33 percent ratio had been achieved, required increases would be lower, averaging approximately three percent per year.

Table 10-3
Additional Revenue Needed to Meet 33 percent Revenue Recovery Ratio
(All Figures in Millions)

	FY91	FY92	FY93	FY94	FY95	FY96
Projected Operating Costs	$575.1	$609.6	$646.1	$684.9	$726.0	$769.6
Projected Revenue w/ Stable Fares	$179.0	$185.5	$192.1	$199.1	$206.3	$213.7
Revenue Required to Meet 33% Revenue Recovery Ratio	$189.8	$201.2	$213.2	$226.0	$239.6	$254.0
Difference	*$10.8*	*$15.7*	*$21.0*	*$26.9*	*$33.4*	*$40.3*
Increase Required	*6.0%*	*8.5%*	*10.9%*	*13.5%*	*16.2%*	*18.9%*

There are a large number of ways in which fare increases could be implemented. For example, they could occur across the board, or they could be applied selectively to certain services, as was done with the last fare increase. Additionally, as discussed later in this chapter, changes made to the fare structure could also increase revenue. For comparison purposes, the ridership and revenue impacts of a number of fare increase options are presented in Table 10-4. These are based on Spring 1989 ridership levels and

elasticities[54] calculated from the impact of the 1981/82 fare changes (-0.22 for rapid transit; -0.19 for surface transit).

Table 10-4
Ridership and Revenue Impacts of Various Fare Increase Options[55]

	Riders Affected (Avg Daily)	Additional Revenue (Annual)	Ridership Impact (Avg Daily)
Increase Cash Fares by 5¢			
Rapid Transit Adult Cash to 80¢	174,300	$3.1 m	-2,600 (-1.5%)
Bus Adult Cash to 55¢	113,670	$2.0 m	-2,200 (-1.9%)
Surface Green Line to 80¢	45,830	$0.5 m	-950 (-2.1%)
Elderly & Disabled to 15¢	75,960	$1.2 m	-7,600 (-10.0%)
Student/Child to 30¢/40¢	30,370	$0.5 m	-1,200 (-3.8%)
Increase Pass Fares by 10%			
Bus Pass to $20	28,830	$0.4 m	-340 (-2.1%)
Subway Pass to $30	99,960	$2.0 m	-1,400 (-2.4%)
Combo Pass to $44	63,420	$1.7 m	-750 (-2.1%)
Combo Plus Pass to $53	12,370	$0.4 m	-150 (-2.2%)

Note: Ridership figures displayed in this table refer to "Average Daily" ridership which includes weekdays and weekends. It should not be confused with "Average Weekday" Ridership.

Elasticities from the 1981/82 fare changes were used instead of from the 1989 fare increase because they were believed to be more reflective of the atmosphere in which future fare increases would occur. The 1989 fare increase took place at a time where many or most riders believed that fares were underpriced and that the increase was fair and reasonable. As a result, there was relatively little opposition. However, now that fares and parking fees have been recently increased, it is likely that subsequent fare increases, if implemented over a short time span, would be met with more opposition and would result in greater ridership impacts.

[54]Transit fares are considered to be inelastic with respect to fare; that is, a change in fares will cause a lower proportional change in ridership. Fare elasticities represent the relationship between between the percentage change in fares and the resulting change in ridership. There is a general rule of thumb in the transit industry – the Simpson Curtain Rule – that for every one percent increase in fare, ridership will decline 0.33 percent. However, depending upon the circumstances of specific fare changes, the ridership change can be much higher or lower.

[55]Based on Spring 1989 ridership levels.

At the same time, because not all fares were increased in 1989, and because some fares are so low, the use of these elasticities may overstate ridership losses. For example, bus fares were not increased in 1989, and therefore an initial increase in bus fares may result in the same small ridership impact as the 1989 rapid transit increase. Also, a 5¢ increase in elderly and disabled fares would represent a 50 percent percentage increase, but a small increase in absolute costs ($2 - $3 per month). The use of fare elasticities does not consider the small increase in absolute costs; only the large percentage increase, which would tend to overstate the impact. Therefore, while elasticities based on the 1981/82 fare changes are believed more appropriate than those based on the 1989 fare changes, the actual changes that could occur if any of the changes are implemented could vary somewhat from the figures above.

For analysis purposes, it was necessary to make a number of assumptions on how fares would be increased to achieve a 33 percent revenue recovery. Overall, it was assumed that the existing fare structure would be maintained, but that future fare increases would be implemented across the board. The existing differential would be maintained between bus and rail fares (with base bus fares set at approximately two-thirds of the base rapid transit fare), students fares would continue to be set at approximately 50 percent of base fares, but elderly and disabled fares would increase by the same amount as base bus fares. It should be stressed that these assumptions are used only for the purposes of analyzing the impacts of a 33 percent revenue recovery ratio in terms of overall ridership and subsidy levels. If a different set of fare assumptions were used, the impacts on *specific* groups would differ, but in most cases, the impact on *total* ridership would not be significantly different. If a 33 percent fare recovery policy, as described herein, were adopted, the MBTA would need to redefine its fare priorities and policies, and then subsequently determine the appropriate fare structure and fare levels.

Using the above assumptions, the fare levels shown in Table 10-5 would be required to achieve a 33 percent revenue recovery ratio by raising fares annually as necessary, or by raising fares no more than every three years. As shown, in FY 1996, fares would be the same under either scenario. However, in other years, fares are higher in the scenario in which fares are raised every third year than they would be if increased every year. For most fare types, raising fares every three years results in fare increases being implemented one to two years earlier than would be necessary using annual increases.

With fare increases, more fare revenue would be collected over the next six years, subsidy levels would be lower, and ridership would also be lower. As was shown in Table 10-3, with constant fare levels, revenue would grow from $173.4 million in FY 1990 to $213.7 million in FY 1996. The large majority of

Table 10-5
Fare Levels to Achieve a 33 percent Revenue Recovery Ratio

	FY91	FY92	FY93	FY94	FY95	FY96
With Annual Fare Increases As Required						
Rapid Transit						
Adult Cash	80¢	85¢	85¢	90¢	90¢	90¢
Monthly Pass	$30	$33	$33	$36	$36	$36
Child/Student	40¢	40¢	40¢	45¢	45¢	45¢
Bus						
Adult Cash	55¢	60¢	60¢	60¢	60¢	65¢
Monthly Pass	$20	$22	$22	$22	$22	$24
Child/Student	25¢	30¢	30¢	30¢	30¢	35¢
Elderly & Disabled	15¢	20¢	20¢	20¢	20¢	30¢
Commuter Rail	+10%	+10%	--	--	--	+10%
With Fare Increases Every Three Years						
Rapid Transit						
Adult Cash	85¢	85¢	85¢	90¢	90¢	90¢
Monthly Pass	$33	$33	$33	$36	$36	$36
Child/Student	40¢	40¢	40¢	45¢	45¢	45¢
Bus						
Adult Cash	60¢	60¢	60¢	65¢	65¢	65¢
Monthly Pass	$22	$22	$22	$24	$24	$24
Child/Student	30¢	30¢	30¢	35¢	35¢	35¢
Elderly & Disabled	20¢	20¢	20¢	25¢	25¢	25¢
Commuter Rail	+20%	--	--	+10%	--	--

this increase would be due to expected ridership growth from 283.2 million trips per year to 343.8 million trips per year. The revenue return ratio would decrease from 32 percent in FY 1990 to 28 percent in FY 1996, and state operating assistance requirements over the same period would increase from $231.8 million to $399.5 million.

With fare increases every year to achieve a 33 percent revenue ratio, FY 1996 revenue would be $255.8 million, or 19.7 percent higher than without fare increases. This would reduce state operating assistance requirements in FY 1996 by 10.5 percent from $399.5 million to $357.4 million. Over the six year period, FY 1991 to FY 1996, a total of $170.0 million in additional revenue would be collected, reducing state operating subsidies by a like amount.[56]

[56]The 33 percent farebox requirement would have no impact on the local assessments to cities and towns in the MBTA district. Operating subsidy requirements would continue to increase at an annual rate of approximately 6.5 percent per year; therefore, local; assessments would continue to increase

Ridership growth would still continue with the assumed fare increases, but at a lower level, with ridership increasing to 324.7 million annual trips (see Table 10-6), as opposed to 343.8 million trips without fare increases.

With fare increases occurring every three years rather than annually, revenue would be slightly higher than with annual increases, and subsidy and ridership levels slightly lower. FY 1996 revenue would be $255.6 million, similar to the revenue generated with annual increases (see Table 10-7). However, over the six year period, an additional $208 million would be generated, as opposed to $170.0 million with annual increases. State operating subsidies would be reduced by $41.9 million by FY 1996 and a total of $207.5 million over the next six years. As with the first scenario, ridership would be lower than without fare increases. With higher increases occurring in FY 1991 to achieve at least 33 percent in FYs 1991, 1992, and 1993, an actual ridership decline would likely occur in FY 1991. However, in other years, and over the six year time span, ridership would increase – from 283.2 million trips per year in FY 1990 to 322.2 million trips per year in FY 1996. This increase would be approximately 2.5 million trips lower than with annual fare increases and 21.6 million less than with constant fares.

Although fare revenue in FY 1996 under either of the fare increase scenarios is similar, ridership would be approximately 0.8 percent lower with increases every three years than with annual increases. Lower ridership but similar revenue would be the result of how the two types of fare changes would affect different ridership groups. With fare increases occurring every three years, the FY 1991 fare increase would range from 13 percent (rapid transit base fares) to 100 percent (elderly and disabled fares). In theory, a 100 percent increase should have a greater percentage impact on ridership than a 13 percent increase, even if both increases are 10¢, Based on the impacts of the 1981/82 fare changes, a 100 percent fare increase would result in a 22 percent decrease in rapid transit ridership, while a 13 percent fare increase would result in less than a three percent decrease. Based on the expectation that the underlying ridership growth rate would be 3.5 percent per year, it would also take much longer to recover from the impacts of a 22 percent ridership drop than from a three percent loss. In the two scenarios examined, the three year increases cause a large initial drop in discounted fare ridership – 20 percent for elderly and disabled ridership and eight percent for child/student ridership. Based on these initial FY 1991 decreases and subsequent ridership losses in FY 1994, it would take much longer to regain this ridership. Compared to the scenario with annual increases, FY 1996 elderly, disabled and child/student would make up a smaller proportion of total ridership, while adult pass ridership would comprise a larger proportion of total ridership. Therefore, with

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at 2.5 percent per year, with additional revenue used to reduce state subsidy requirements.

Table 10-6
Projected Budgets with a 33% Revenue Recovery Ratio and Annual Increases as Necessary: 1989 - 1996
(All figures in 000s)

	FY 1989 Estimated	FY 1990 Budget	FY 1991 Budget	FY 1992 Projected	FY 1993 Projected	FY 1994 Projected	FY 1995 Projected	FY 1996 Projected
Operating Costs								
Basic System	$420,397	$450,258	$481,836	$510,746	$541,391	$573,874	$608,307	$644,805
Commuter Rail	$84,133	$88,553	$93,230	$98,824	$104,753	$111,038	$117,701	$124,763
Total	$504,530	$542,695	$575,066	$609,570	$646,144	$684,913	$726,008	$769,568
Fare Revenue								
Bus & Rapid Transit	$114,533	$128,100	$140,900	$154,900	$160,300	$172,200	$178,200	$189,500
Commuter Rail	$27,882	$33,500	$38,100	$42,400	$43,900	$45,400	$47,000	$50,700
Total	$142,415	$161,300	$179,000	$197,300	$204,200	$217,600	$225,200	$240,200
Other Revenue	$7,297	$12,174	$12,242	$12,900	$13,500	$14,200	$14,900	$15,600
Total Revenue	$149,712	$173,474	$191,242	$210,200	$217,700	$231,800	$240,100	$255,800
Cost in Excess of Income	$354,818	$369,221	$383,824	$399,370	$428,444	$453,113	$485,908	$513,768
Subsidies								
UMTA Section 9	$18,640	$18,810	$18,810	$18,810	$18,810	$18,810	$18,810	$18,810
Local Assistance	$115,748	$118,642	$121,608	$124,648	$127,764	$130,959	$134,233	$137,588
State Operating Assistanc	$220,430	$231,769	$243,406	$255,912	$281,870	$303,344	$332,865	$357,370
Total Subsidies	$354,818	$369,221	$383,824	$399,370	$428,444	$453,113	$485,908	$513,768
Revenue Recovery Ratio (Excluding Debt Service)								
Bus & Rapid Transit	29.0%	31.2%	31.8%	32.9%	32.1%	32.5%	31.7%	31.8%
Commuter Rail	33.1%	37.8%	40.9%	42.9%	41.9%	40.9%	39.9%	40.6%
All Modes	29.7%	32.0%	33.3%	34.5%	33.7%	33.8%	33.1%	33.2%
Annual Ridership								
Bus & Rapid Transit	255,201	264,100	265,400	268,300	277,700	285,200	295,200	302,300
Commuter Rail	18,621	19,100	19,300	19,500	20,200	20,900	21,600	22,400
Total Ridership	273,822	283,200	284,700	287,800	297,900	306,100	316,800	324,700
Rapid Transit Fares								
Adult Cash	60¢	75¢	80¢	85¢	85¢	90¢	90¢	90¢
Adult Monthly Pass	$22	$27	$30	$33	$33	$36	$36	$36
Child/Student	30¢	35¢	40¢	40¢	40¢	45¢	45¢	45¢
Bus Fares								
Adult Cash	50¢	50¢	55¢	60¢	60¢	60¢	60¢	65¢
Adult Monthly Pass	$18	$18	$20	$22	$22	$22	$22	$24
Child/Student	25¢	25¢	25¢	30¢	30¢	30¢	30¢	35¢
E&H (RT & Bus) Fares	10¢	10¢	15¢	20¢	20¢	20¢	20¢	25¢
Commuter Rail Fares								
Cash & Pass Increase		+24%	+10%	+10%	0%	0%	0%	+10%

Table 10-7
Projected Budgets with a 33% Revenue Recovery Ratio and Fare Increases Every Three Years: 1989 - 1996
(All figures in 000s)

	FY 1989 Estimated	FY 1990 Budget	FY 1991 Budget	FY 1992 Projected	FY 1993 Projected	FY 1994 Projected	FY 1995 Projected	FY 1996 Projected
Operating Costs								
Basic System	$420,397	$450,258	$481,836	$510,746	$541,391	$573,874	$608,307	$644,805
Commuter Rail	$84,133	$88,553	$93,246	$98,841	$104,771	$111,057	$117,721	$124,784
Total	$504,530	$542,695	$575,082	$609,587	$646,162	$684,932	$726,028	$769,589
Fare Revenue								
Bus & Rapid Transit	$114,533	$128,100	$154,100	$158,700	$163,500	$178,400	$183,800	$189,300
Commuter Rail	$27,882	$33,500	$40,600	$41,800	$42,100	$47,800	$49,200	$50,700
Total	$142,415	$161,300	$194,700	$200,500	$205,600	$226,200	$233,000	$240,000
Other Revenue	$7,297	$12,174	$12,242	$12,900	$13,500	$14,200	$14,900	$15,600
Total Revenue	$149,712	$173,474	$206,942	$213,400	$219,100	$240,400	$247,900	$255,600
Cost in Excess of Income	$354,818	$369,221	$368,140	$396,187	$427,062	$444,532	$478,128	$513,989
Subsidies								
UMTA Section 9	$18,640	$18,810	$18,810	$18,810	$18,810	$18,810	$18,810	$18,810
Local Assistance	$115,748	$118,642	$121,608	$124,648	$127,764	$130,959	$134,233	$137,588
State Operating Assistanc	$220,430	$231,769	$227,722	$252,729	$280,488	$294,763	$325,085	$357,591
Total Subsidies	$354,818	$369,221	$368,140	$396,187	$427,062	$444,532	$478,128	$513,989
Revenue Recovery Ratio (Excluding Debt Service)								
Bus & Rapid Transit	29.0%	31.2%	34.5%	33.6%	32.7%	33.6%	32.7%	31.8%
Commuter Rail	33.1%	37.8%	43.5%	42.3%	40.2%	43.0%	41.8%	40.6%
All Modes	29.7%	32.0%	36.0%	35.0%	33.9%	35.1%	34.1%	33.2%
Annual Ridership								
Bus & Rapid Transit	255,201	264,100	257,800	266,800	276,200	280,200	290,000	300,200
Commuter Rail	18,621	19,100	18,900	19,600	20,200	20,500	21,200	22,000
Total Ridership	273,822	283,200	276,700	286,400	296,400	300,700	311,200	322,200
Rapid Transit Fares								
Adult Cash	60¢	75¢	85¢	85¢	85¢	90¢	90¢	90¢
Adult Monthly Pass	$22	$27	$33	$33	$33	$36	$36	$36
Child/Student	30¢	35¢	40¢	40¢	40¢	45¢	45¢	45¢
Bus Fares								
Adult Cash	50¢	50¢	60¢	60¢	60¢	65¢	65¢	65¢
Adult Monthly Pass	$18	$18	$22	$22	$22	$24	$24	$24
Child/Student	25¢	25¢	30¢	30¢	30¢	35¢	35¢	35¢
E&H (RT & Bus) Fares	10¢	10¢	20¢	20¢	20¢	25¢	25¢	25¢
Commuter Rail Fares								
Cash & Pass Increase		+24%	+20%	0%	0%	+10%	0%	0%

increases every three years, while total ridership would be one percent lower, there would be more full fare riders and fewer discount fare riders than with annual increases, so that revenue would not be significantly lower.

Figures 10-4 through 10-7 display projected distributions of ridership losses caused by the two fare increase scenarios. Figures 10-4 and 10-5 display the number of trips that would be lost in 1996 if fares were to be raised annually as needed to maintain the 33 percent farebox recovery ratio. Towns along the commuter rail lines would be expected to have the most significant losses (see Figure 10-4), since these are the towns which currently have the highest ridership. However, most losses are relatively small. In the core area (shown in Figure 10-5), much greater losses would be expected, as these areas have very high current ridership. The largest losses would be expected in areas along the rapid transit lines and the surface Green Line in Cambridge, Brighton, and the downtown area.

Figures 10-6 and 10-7 present parallel distributions of ridership losses under the scenario of raising fares every third year. The distribution of losses under this scenario is similar to the above, but losses tend to be greater across the board. As shown, there are several traffic zones in higher categories than on the previous maps, notably in Quincy and Braintree.

The figures presented above also imply that fare increases staged every three years would have a greater impact on disadvantaged riders than would annual increases. Since increases would occur sooner, this is undoubtedly true to a certain extent. However, during most years between FY 1991 and FY 1996, there would be no difference in fares using either method, and where there were differences, they would be no more than 5¢ per trip ($2 - $3 per month). Considering this, and the observed impacts of the 1989 fare increase, the use of elasticities may overstate ridership impacts when the original fare is low and the increase is considered to be reasonable. Therefore, an increase in elderly and disabled fares from 10¢ to 20¢ would likely result in much less than a 20 to 22 percent ridership loss, and the overall ridership impacts of fare increases every three years would likely be closer to those predicted for annual increases. With this in mind, the state subsidy levels and ridership levels for constant fares, annual fare increases, and fare increases every three years, is shown in Figures 10-8 and 10-9.

OTHER IMPACTS

Impact of Higher Costs/Lower Ridership

The fare and subsidy figures presented above are based on current MBTA projections that operating costs will increase at an average rate of six percent

Figure 10-4
1996 Annual Ridership Loss
Under Annual Fare Increase Scenario
by CTPS Traffic Analysis Zone

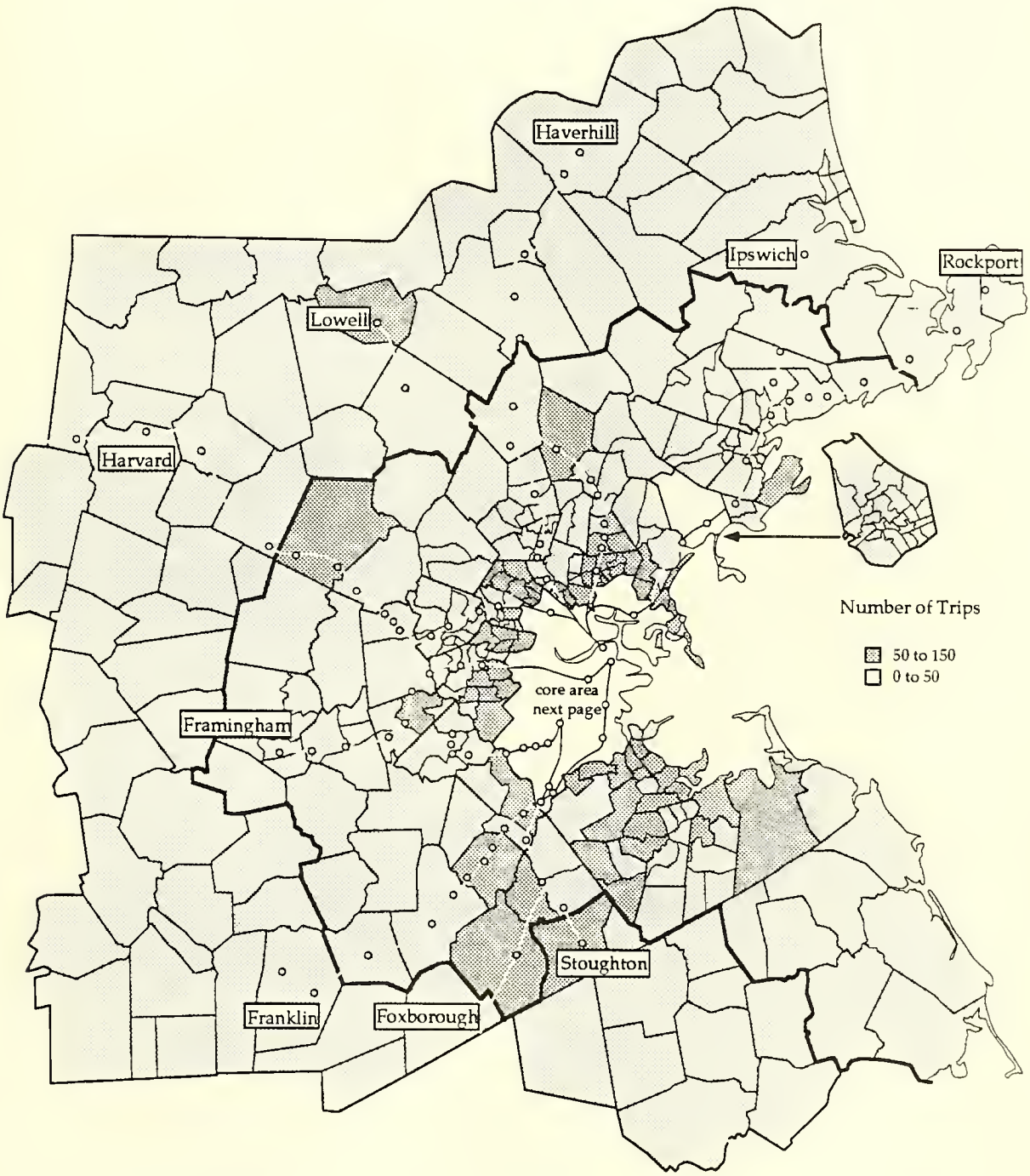


Figure 10-5
1996 Annual Ridership Loss
Under Annual Fare Increase Scenario
by CTPS Traffic Analysis Zone

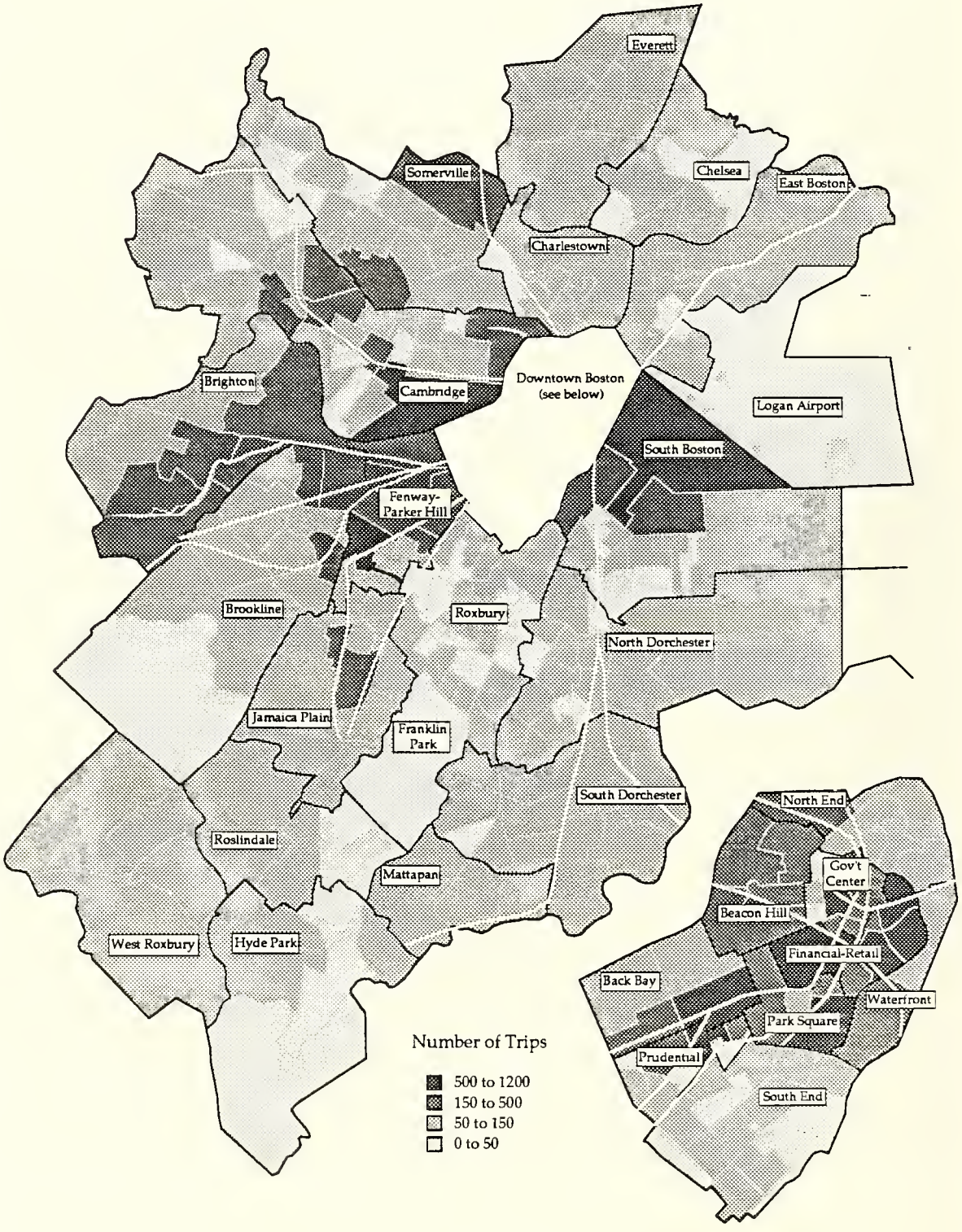


Figure 10-6
1996 Annual Ridership Loss
Under Triennial Fare Increase Scenario
by CTPS Traffic Analysis Zone

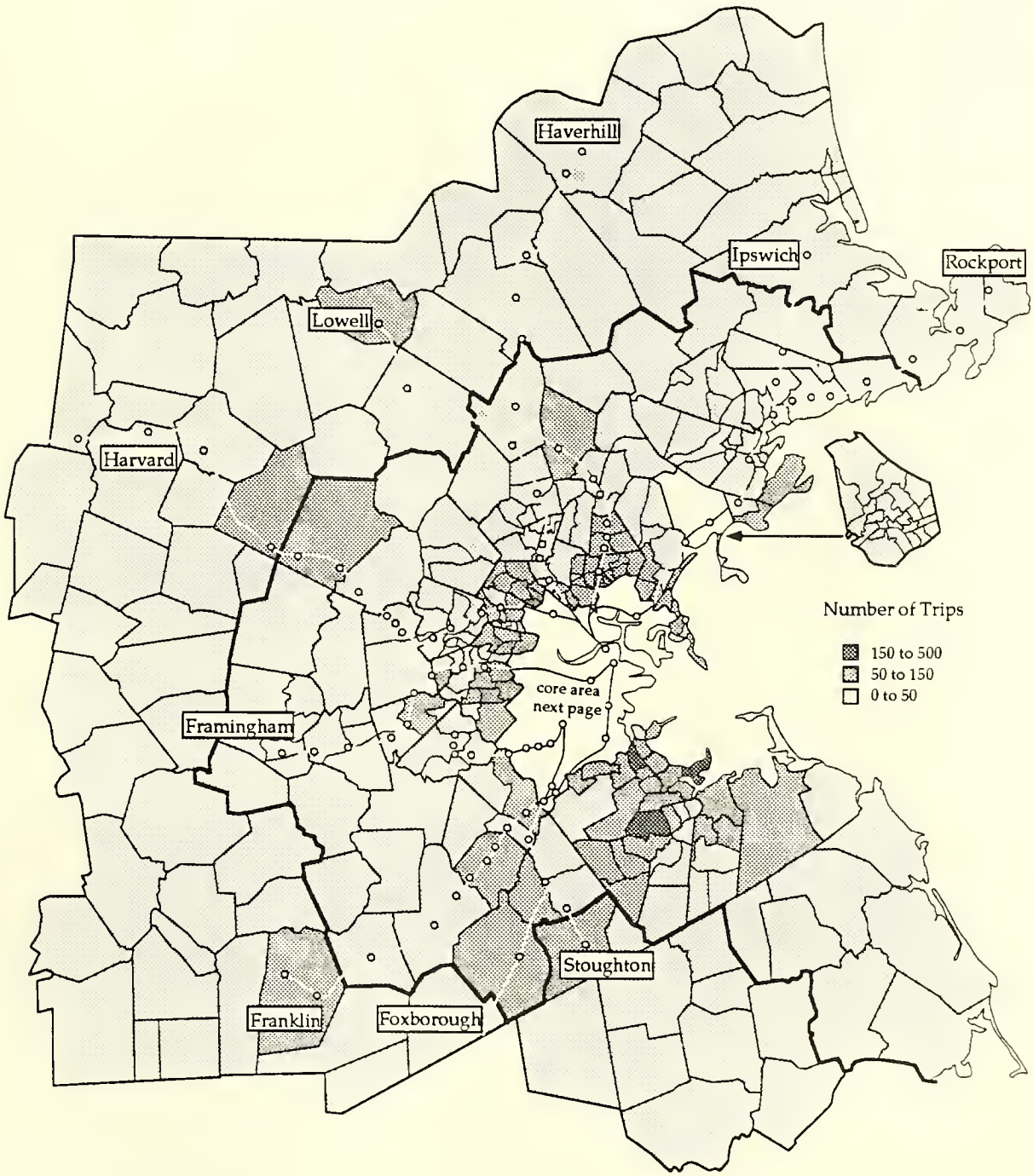


Figure 10-7
1996 Annual Ridership Loss
Under Triennial Fare Increase Scenario
by CTPS Traffic Analysis Zone

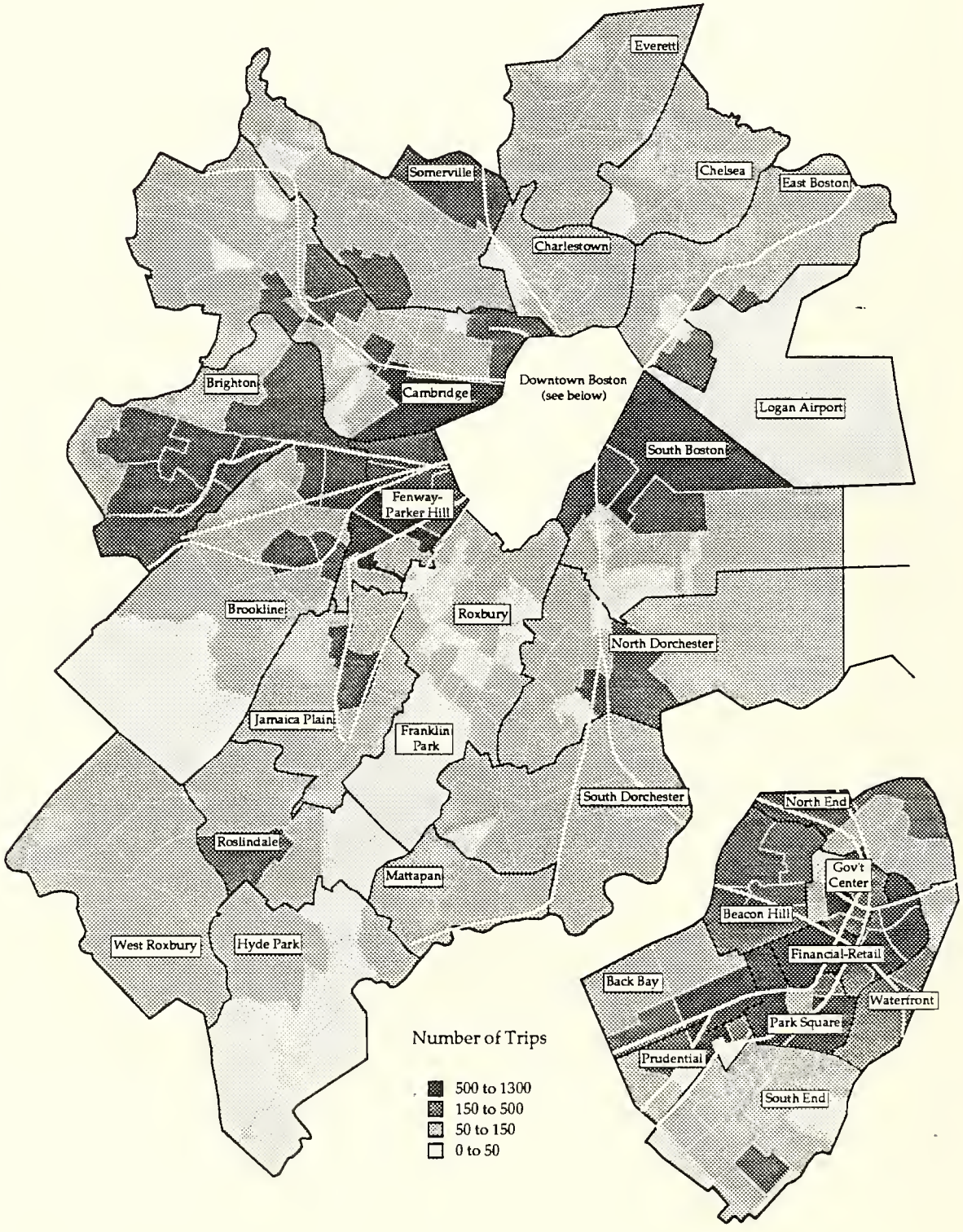


Figure 10-8
State Operating Assistance Required
with/without 33 Percent Revenue Recovery Ratio

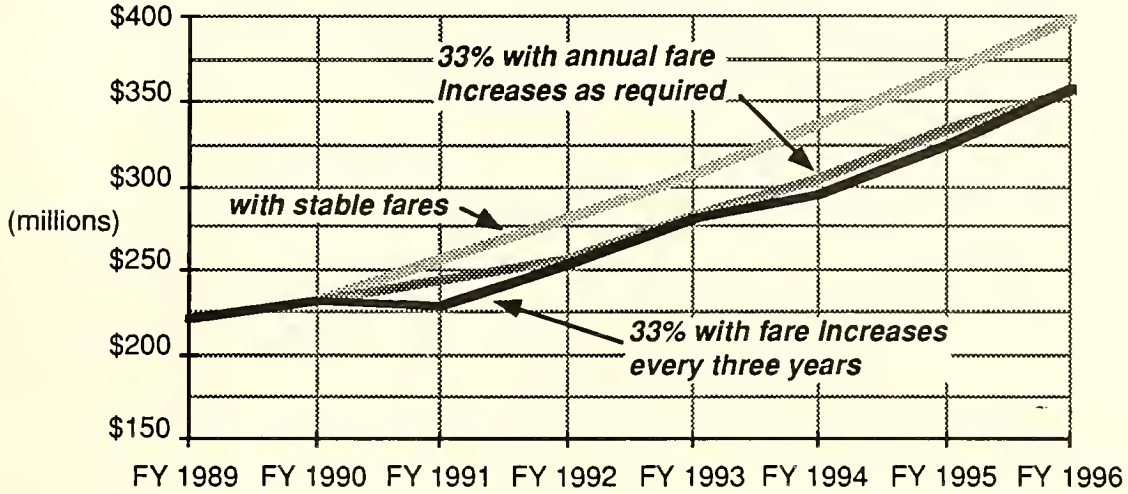
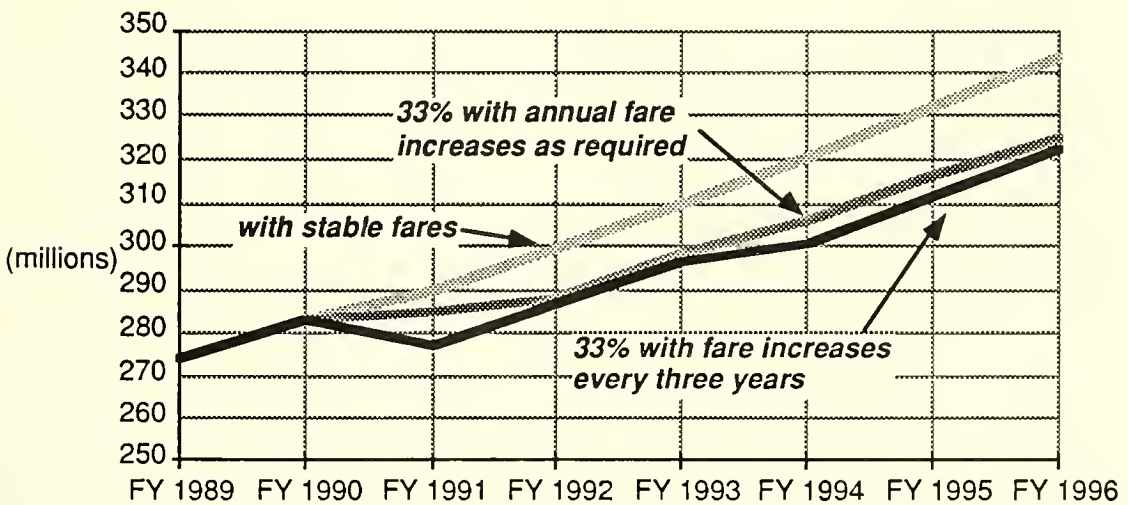


Figure 10-9
Annual MBTA Ridership
with/without 33 Percent Revenue Recovery Ratio
(Unlinked Trips)



per year and that ridership will increase at an average rate of 3.5 percent. If either costs are higher, or ridership increases lower, then higher fares would be needed to achieve a 33 percent revenue recovery ratio.

For example, for FY 1990, the Local 589 arbitration ruling increased MBTA operating costs $18.1 million beyond budgeted levels. With a 33 percent revenue recovery requirement, this would mean that FY 1990 operating revenue would need to be increased by $6.0 million. This would have required a second fare increase to increase rapid transit fares by another 5¢ and subway and combo pass prices by approximately 10 percent.

Higher than expected inflation would also increase costs to higher than expected levels and require higher fare increases than projected above. If costs increased at a rate of 10 percent per year instead of six percent, FY 1996 operating costs would be $926.2 million instead of the projected $769.6 million. The difference of $156.6 million would require that revenue be increased by an additional $52.2 million. For FY 1996, this would mean that all fares would need to be 20¢ higher than with cost increases averaging six percent, and commuter rail and pass costs would need to be increased by 20 to 30 percent (see Table 10-9).

Table 10-9
Impact of Inflation on FY 1996 Fare Levels
to Meet a 33 Percent Revenue Recovery Requirement

	If Operating Costs Increase 6%/Yr	If Operating Costs Increase 10%/Yr
Rapid Transit Fares		
Adult Cash	90¢	$1.10
Adult Monthly Pass	$36	$44
Child/Student	45¢	55¢
Bus Fares		
Adult Cash	65¢	85¢
Adult Pass	$24	$31
Child/Student	35¢	50¢
Elderly & Disabled Fare	25¢	45¢

Lower than expected ridership would also require higher fares. With ridership expected to increase by 3.5 percent per year, revenue revenue is expected to increase by $5.9 to 6.7 million per year. If this does not occur, then fares would need to be increased high enough to generate that amount. To generate approximately six million dollars would require a rapid transit fare to be increased by 5¢ and subway and combo pass prices to be increased by three to five dollars.

Of the three factors, high inflation would have the greatest potential adverse impact. With unexpected cost increases in the magnitude of the Local 589

arbitration award, or with level ridership instead of increasing ridership, a 33 percent revenue return requirement could be met by raising fares by 5¢. However, with inflation at 10 percent, fares would need to be increased by 20¢.

Impact on Low Income Riders/Loss of Flexibility to Keep Fares Low

Any type of price increase affects low income persons to a greater extent than high income persons. Since a 33 percent revenue requirement could result in higher fares than would otherwise be charged, low income riders would be affected the most.

Between 1983 and 1989, the MBTA kept fares stable by requesting additional funding from the state to fund increasing operating deficits. With the onset of current state budget problems, and at the urging of the Advisory Board, this practice changed and fares were increased. However, once state budget problems are resolved, if other subsidies become available to lessen the impact of future inflation, it may once again become advisable to hold fares at lower levels than would be required by a 33 percent revenue recovery ratio. With a revenue recovery requirement, there would be considerable less flexibility to set fare levels independently. This, in turn, could make transportation less accessible to low income persons to the degree that fare increases exceeded increases in personal or household income.

Inclusion of Debt Service and Interest Income in a 33 Percent Revenue Recovery Requirement

As previously stated, impacts of a 33 percent revenue requirement were based on the industry definition of revenue ratios, which does not include capital related income or expenses. Between FY 1990 and FY 1996, the cost of debt service is projected to increase at an annual rate of 15 percent from $124.3 million to $287.5 million. To fund 33 percent of these costs would require fare increases of $41 to $95 million in addition to the fare increases discussed above. This would require fare increases of up to 32 percent in FY 1991 to up to 69 percent in FY 1996. In FY 1991, this would require a $1.00 rapid transit fare, a 65¢ bus fare, and corresponding pass increases. For FY 1996, this would require $1.25 rapid transit fare, an 85¢ bus fare and corresponding pass increases.

Impact of Passenger Comfort/Crowding

Since 1983, a major focus of the MBTA, as well as the State and the City of Boston with respect to transit, has been to upgrade and expand MBTA service to provide a more comfortable and attractive service for existing riders as well as to attract additional riders. This has resulted in a number of improvements such as longer Red Line, Orange and commuter rail trains, which has increased operating costs. With a revenue return requirement,

there may be increased pressure to only implement service improvements that would increase ridership, and not those that would benefit existing riders (for example, adding service to an overcrowded bus route). Further, in years where fare increases are necessary, there would likely be pressure to cut expenditures rather than to raise fares. Often when this is the case, expenditures are cut in areas such as maintenance where there is little short term impact, but that result in significantly higher long term costs

Impact on Future VMT and Air Quality

An air quality analysis was conducted to predict the magnitude of change in future year carbon monoxide and hydrocarbon concentrations as a result of the implementation of two phasing mechanisms for implementing the 33% Revenue Recovery Ratio. MOBIL 4, a standard air quality model, was used to calculate CO and HC for these future alternatives. Emissions factors, as is standard practice, were chosen based on worst case metrological conditions for each of the pollutants.

The VMT growth which results from passenger loss and diversions to modes of travel with higher pollution emissions per passenger is summarized below in terms of total change in emissions (see Table 10-10). From this brief analysis it is clear that this measure will not be supportive of the MBTA's goal of reducing the number of vehicle miles travelled regionwide by drawing automobile users to the transit system. However, in interpreting this information, it is important to weigh the environmental impacts against the alternative of no MBTA revenue increases. For example, if such an alternative were to force major reductions in MBTA service, there would certainly be countervailing pollution effects, which would need to be considered and balanced against these emissions. Depending on their

Table 10-10
VMT and Air Quality Impacts of
a 33 Percent Revenue Recovery Requirement

	1989 Actual	Projected w/ Annual Fare Increases	Projected w/ Triennial Fare Increases
Total Ridership Change (per day)	3,540	43,217	48,959
Change in VMT (per day)	33, 487	247,392	286,475
Estimated Change in NMHC Emissions (kg/day)	60.9	450.2	521.4
Estimated Change in CO Emissions (kg/day)	751.8	5,553.9	6,431.4

severity, service cuts might do more harm to MBTA ridership trends (and thus to long term VMT growth and pollution emissions) than the pollution changes enumerated below.

THE COST OF IMPLEMENTING FARE INCREASES

Based on the experience from the 1981 fare increase, the MBTA focussed on providing a much higher level of marketing and advance information for the 1989 fare increase to explain both the increase itself and the rationale for the increase. Further, the MBTA believed that the public, which had been showing increased satisfaction with MBTA service, would be willing to support the increase.

Public information was provided through an information campaign that included newspaper articles, leaflets, and a series of six posters presenting specific information on the increase and a summary poster with the points that had been made. In addition, on the day of the increase, more than 100 MBTA employees were at stations to answer questions about the new fares, the new passes and to encourage passengers to use the new token ten-packs. Overall, once begun, the fare increase process went extremely smoothly and without widespread opposition.

The direct cost of the marketing effort was low. Excluding the cost of MBTA personnel diverted from their normal duties, the cost for printing brochures, posters and marketing pieces was approximately $28,000.

FARE RECOVERY ISSUES – SUMMARY/CONCLUSIONS

With moderate inflation and continued ridership growth, a 33 percent revenue level could be achieved with relatively moderate fare increases and with continuing ridership growth. If general inflation is high and yet if the costs of operating the system are less effected, the fare increases described here will be less in **real dollars** and are likely to have less of an impact than described here. However, if higher inflation occurs for costs (energy, etc.) or if there are other higher than anticipated cost increases, significantly higher fare increases would be required that could result in lower ridership levels.[57]

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[57]Since the projections contained herein indicate that a 33 1/3 percent recovery requirement would not result in large ridership losses, the issue of how to deal with large ridership losses (i.e., greater than 15 percent) has not been specifically addressed. (Continued next page.)

If fares were raised to achieve a 33 percent revenue return, state operating subsidies would be reduced, but there would be no impact on local assessments. With 33 percent revenue return, operating subsidy requirements would still increase at an annual rate of approximately 6.5 percent per year. Therefore, local assessments would continue to increase at 2.5 percent per year, with additional revenue used to reduce state subsidy requirements. State subsidy costs would be reduced by between $22 million (in FY 1991) and $42.1 million (in FY 1996) per year. Total savings to the state between FY 1991 and FY 1996 could be as high as $208 million.

A 33 percent revenue recovery requirement would change current MBTA budgeting and funding practices so that minimum fare levels would be set based on the overall operating budget, rather than independently. The impact of the loss of flexibility by the MBTA to keep fares low would depend on a number of external factors. With continued low inflation and ridership growth, it may not be significant. However, with high inflation, or if ridership began to decline, a revenue recovery requirement may leave the MBTA unable to make fare changes that may be necessary to prevent ridership losses or to stabilize ridership.

Overall, a revenue recovery requirement would impact fares and/or service. However, the specific impacts would be dependent to a large extent on future economic conditions that would not be known when the requirement was

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The large drop in ridership in 1981-82 was the result of fare increases much larger than any considered in this analysis – bus fares were increased 100 percent from 25¢ to 50¢, and rapid transit fares were increased 50 percent from 50¢ to 75¢. By contrast, the increases required to maintain a $33^1/_3$ percent revenue recovery ratio would be much lower, at 20 percent or less (usually less than 10 percent). Therefore, *under normal conditions*, there is no reason to expect that fare increases of the magnitude discussed in this report would result in large ridership losses.

However, it is possible that certain circumstances could require fare increases large enough to cause large ridership losses. These could include a prolonged period of high inflation, as occurred in the early 1980's (which would require large fare increases to meet the $33^1/_3$ percent requirement), or severe cuts in funding from one or more sources. In the event that this did occur, the MBTA would review the fare increase, its services, and (continued next page) its operations (including cost structure) to attempt to identify ways to regain lost ridership. However, whether fares would be reduced, as in 1982, would depend upon the MBTA's ability to offset the revenue loss of a fare decrease through additional funding or non-fare operating revenue, or cost reductions, or a combination of all three.

imposed. If inflation stays low and ridership continues to grow, the impact should be slight. However, if inflation or other factors significantly increase costs, large fare increases would be required which would likely result in declining ridership. Because future economic conditions cannot be accurately predicted, the MBTA believes that operating costs and fare levels should be examined directly, rather than indirectly through the implementation of a revenue return requirement. As presented herein, a 33 percent revenue requirement would result in significant saving in state operating subsidies. However, those same savings could be achieved by implementing similar fare increases without a revenue return requirement.

11. Fare Structure Options & Fare Collection Issues

FARE STRUCTURE OPTIONS

The existing MBTA fare structure can be considered the combination of a flat-fare system and a zone-based system. While all modes operate based on a zone system, the large majority of all trips are made within one zone. Therefore, most riders consider it a flat-fare system and are charged the same as they would be under a "pure" flat-fare system. Exceptions are the commuter rail system and express bus service, where most riders pay more than base fares. With only a few exceptions, free transfers are permitted only within the rapid transit system. No free or discounted transfers are permitted between modes or between buses. (However, various monthly passes do include the equivalent of free or discounted transfers.)

The MBTA believes that the current fare structure is effective in meeting its four major objectives: (1) that the fare structure be easy to use and understand, (2) that it be easy to administer and that administration costs are minimized, (3) that it be designed to minimize fare evasion, and (4) that it be equitable. The MBTA also believes that the full fare transfer charge policy introduces distance-based charges into a flat-fare system on the assumption that trips involving two bus routes or bus-rapid transit transfers are longer than trips that do not involve transfers.

In most cases, the existing fare structure does satisfy the first three objectives. Although the fare structure is becoming more complicated to accommodate more special cases (free and discounted transfers on Southwest corridor bus routes that connect to the new Orange Line, Route 39 Arborway replacement service, the surface Green Line, local Red Line trips between Quincy and Braintree, and the Mattapan High Speed Line, among others), a large majority of all passengers pay the same fare for similar services throughout the system. The absence of transfers does make the fare structure easier to administer, does reduce administrative costs, and does avoid fare evasion that can occur with most transfer systems.

Most other major transit systems permit free or discounted transfers of some sort for cash paying riders and charge the same base fare for bus and rapid transit service (see Table 11-1). In addition, other transit systems use more

structured zone systems than does the MBTA (BC Transit and PAT), and two (BART and WMATA)[58] use automated distance-based fare structures.

Table 11-1
Bus/Rail Fare Differentials and Transfer Charges at Major North American Transit Agencies[59]

Agency/City	Base Fares		Transfer Charges		
	Bus	Rail	Bus-Bus	Bus-Rail	Rail-Bus
BC Transit/Vancouver	$1.15	$1.15	free	free	free
CTA/Chicago	90¢	$1.00	25¢	25¢	25¢
GRCTA/Cleveland	85¢	$1.00	free	15¢	free
MBTA	**50¢**	**75¢**	**50¢**	**75¢**	**50¢**
MTA/Maryland	90¢	75¢	10¢	10¢	10¢
NYCTA/New York	$1.15	$1.15	free	$1.15	$1.15
PAT/Pittsburgh	$1.00	$1.00	25¢	25¢	25¢
SEMTA/Detroit	$1.00	$1.00	10¢	$1.00	$1.00
SEPTA/Philadelphia	$1.25	$1.25	25¢	25¢	25¢
Muni/San Francisco	85¢	85¢	free	free	free
SCCTD/San Jose	75¢	75¢	free with Day Pass[60]		
TTC/Toronto	$1.10	$1.10	free	free	free
WMATA/Washington	80¢	80¢	free	80¢	free

The lack of free or discounted transfers allows base fares to be set at lower levels than would otherwise be possible – to achieve the same amount of revenue, base fares would have to be increased to offset the revenue lost due to free transfers. As shown in Table 11-2 and as discussed further below, for trips that involve transfers, MBTA fares are comparable to other systems.

Due to unique characteristics of individual areas, there is no "best" fare structure for any given system. However, it is possible that certain characteristics of other fare structures, as listed below, could be implemented by the MBTA to make fares more equitable without sacrificing benefits of the existing structure.

[58]Bay Area Rapid Transit in the San Francisco Bay Area, and Washington Metropolitan Area Transit Authority in the Washington D.C. area.
[59]Source: "MBTA Fares, An Analysis of Current Policy and Practice," MBTA Advisory Board, January 1989 (updated), and fare schedules from the individual transit agencies. Fares for Canadian systems are in Canadian dollars.
[60]Day Passes are sold for $1.50 and offer unlimited service that day.

Table 11-2
Fare Comparisons Among Major North American Transit Agencies

Agency/City	Type of Trip				
	Bus Only	Rail Only	Bus-Bus	Bus-Rail	Rail-Bus
BC Transit/Vancouver	$1.15	$1.15	$1.15	$1.15	$1.15
CTA/Chicago	90¢	$1.00	$1.15	$1.15	$1.25
GRCTA/Cleveland	85¢	$1.00	85¢	$1.00	$1.00
MBTA	**50¢**	**75¢**	**$1.00**	**$1.25**	**$1.25**
MTA/Maryland	90¢	75¢	85¢	95¢	$1.00
NYCTA/New York	$1.15	$1.15	$1.15	$2.30	$2.30
PAT/Pittsburgh	$1.00	$1.00	$1.25	$1.25	$1.25
SEMTA/Detroit	$1.00	$1.00	$1.10	$2.00	$2.00
SEPTA/Philadelphia	$1.25	$1.25	$1.50	$1.50	$1.50
Muni/San Francisco	85¢	85¢	85¢	85¢	85¢
SCCTD/San Jose[61]	75¢	75¢	75¢	75¢	75¢
TTC/Toronto	$1.10	$1.10	$1.10	$1.10	$1.10
WMATA/Washington	80¢	80¢	80¢	$1.60	80¢

- Revised zone system.
- Elimination of fare differential between bus and rapid transit.
- Free/discounted transfers between all rapid transit and local bus services.
- Free/discounted transfers at certain rapid transit stations.
- Free/discounted transfers between specific bus routes and rapid transit.
- Free/discounted transfers between local bus routes.
- Free/discounted transfers between express bus and rapid transit.
- Peak/off-peak pricing.
- Distance-based fare system for rapid transit (similar to BART or WMATA, but taking into account surface Green Line operations).
- Adjust discounts provided to different ridership groups and those using passes.

The implementation of any one or more of the above options would affect both fares and ridership. For example, if free transfers were provided throughout the system, base fares would need to be increased to compensate for the loss of transfer revenue. Higher base fares would likely lead to a decrease in the number of trips not involving transfers, but free transfers would likely result in an increase in the number of transfer trips. While the estimation of specific fare and ridership impacts of different structure alternatives is beyond the scope of this analysis, a number of more general

[61]Transfer trip costs assume purchase of a Day Pass.

impacts can be predicted. These are discussed below with respect to the existing fare structure.

Existing Fare Structure

As discussed above, the existing MBTA fare structure is a zone-based system but the large majority of all trips are made within the first zone. On the rapid transit system, Zone 1 extends approximately six miles from downtown Boston, with additional zones extending approximately three miles. Zone 1 adult cash fares are now 75¢ (up from 60¢) in each direction or $1.50 round trip. Zone 2 fares are $1.50 inbound and 75¢ outbound for a round trip fare of $2.25. Zone 3 fares are $1.50 in each direction, resulting in a round trip fare of $3.00.

Zone 1 encompasses all of the rapid transit system except the Braintree branch of the Red Line beyond JFK/U Mass, and the Riverside branch of the Green Line beyond Reservoir. However, there are a number of exceptions:

- On the Riverside branch of the Green Line, there are no paid station areas, but it is necessary to open all doors in the outbound direction to deboard passengers efficiently. As a result, it would be difficult to enforce the payment of fares. Instead of attempting to do so, outbound boardings on the surface are free, but higher inbound fares are charged. Between Fenway Park and Reservoir, the inbound adult fare is 90¢, and between Chestnut Hill and Riverside, it is $1.75.

  For local trips between Fenway Park and Reservoir, this fare structure permits round trips to be made for 90¢, or 45¢ each way, which is less than base local bus and rapid transit fares. For local trips between Reservoir and Riverside, the $1.75 inbound charge would result in a 88¢ one-way fare, which would be higher than the base rapid transit fare. To avoid this, inbound riders can request a coupon when exiting the train that allows the next inbound trip to be made for 90¢. This reduces the effective one-way fare to the same 45¢ charged Fenway Park to Reservoir riders.

  On the Cleveland Circle and Boston College branches of the Green Line, the inbound fare is 75¢, and there is no outbound fare. This results in an effective one-way fare of 37.5¢ for surface-only rides.

- On the Red Line, although the North Quincy and Wollaston stations are more than six miles from downtown Boston,[62] they are operated as Zone

[62]Distance from downtown Boston is considered to be the distance from the area of the four major transfer stations – Park Street, Downtown Crossing, State, and Government Center.

1 stations, leaving Quincy Center as the only Zone 2 station in the system. (Quincy Adams and Braintree stations are in Zone 3 and are operated as Zone 3 stations.) At Quincy Center, an inbound fare of $1.50 is charged. This combined with a 75¢ outbound fare, results in an effective $1.13 one-way fare. At Zone 3 stations, a $1.50 entrance fare is charged and a 75¢ exit fee is charged. This results in a $1.50 fare in each direction.

For local trips within Zone 3 or between Zone 3 and Quincy Center, a 75¢ rebate is given, which reduces the fare to 75¢ in each direction – the same as Zone 1 fares.

- On the Mattapan High Speed line, a 50¢ fare is charged inbound riders that exit before Ashmont. For riders that exit at Ashmont, no fare is charged (on the assumption that these riders are transferring to the Red Line and will pay a 75¢ fare there (although approximately 25 percent do not). No outbound fares are charged. This fare structure results in an effective 25¢ one-way fare for local riders – the lowest in the MBTA system.

On local bus service, the zone system is used but is based on the length of the bus route, not the distance from downtown Boston. The first six miles of a route are considered to be in the first zone, with additional zones added for each additional three mile increment (or portion thereof). In total, 38 bus routes operate as zoned routes containing up to five zones, with fares ranging from the base fare of 50¢ to a five-zone fare of $1.50.

As with the rapid transit system, there are also a number of fare and transfer exceptions. For the most part, these have been adopted when rapid transit service has been replaced with bus service in order to avoid imposing higher fares for replacement services. Examples are Route 39, which replaced discontinued service on the Arborway Line, and Routes 1 and 49, which provide feeder service to the new Orange Line from areas that previously were served by the old Orange Line. On Route 39, rapid transit fares are charged (75¢ base fare), and free transfers are permitted to the rapid transit system. On Route 1, a 25¢ transfer is permitted to the rapid transit system and free transfers are permitted from the rapid transit system; in addition, SUBWAY passes are also accepted. Route 49 has the same fare structure as other bus routes, but as with Route 1, SUBWAY passes are accepted.

A similar zone system is used on express bus service, but with a base fare of $1.25 and only three zones. Adult cash fares for trips from Zone 2 are $1.65, and from Zone 3 are $1.90. On some express routes, local trips are not permitted, while on others they are allowed.

The commuter rail system operates as a zoned service with up to nine zones measured in approximate distance from North or South Station. Commuter rail zones are similar to rapid transit zones, in that the first zone (Zone 1A) extends as far as Zone 1 on the rapid transit system, with additional zones also approximately three miles in length. However, due to other considerations, such as balancing demand between two nearby stations, or attracting ridership to underutilized inner stations, several exceptions to the zone system exist.

Revised Zone System

As described above, the MBTA zone system differs among modes and a large number of exceptions exist. As further discussed below, the existing zone system appears appropriate considering the type of fare collection methods used (also see section on Fare Collection Alternatives, below), and in the context of the MBTA's fare structure objectives. However, some of the exceptions made to the zonal system should be re-examined, especially with respect to the North Quincy and Wollaston Stations.

Rapid Transit On the rapid transit system, changes to the zone system could involve the creation of additional zones, or the elimination of zones. The creation of additional zones to create a more distance-based fare structure would require that the first zone be reduced in size. If, for example, Zone 1 was reduced from six miles to five miles with additional zones maintained at three miles, Alewife and Oak Grove stations would shift to Zone 2, Quincy Center would shift to Zone 3 and Braintree would shift to a new Zone 4. These changes would result in the need to expand the warrant system used for Braintree-Quincy trips to the Alewife end of the Red Line and to the north end of the Orange Line. At Alewife, 22 percent of all riders, accounting for over 2,100 trips per day, travel to destinations within Cambridge and would use the warrant system (similar figures are not available for Oak Grove). This, combined with the addition of a fourth zone for the Braintree station would make the fare system more confusing, more difficult to administer, and create longer lines at station agent booths where warrants would be redeemed.

The elimination of rapid transit zones would simplify the fare structure and fare collection by allowing the same fare to be charged at all stations and eliminating the warrant system, but would make the fare structure less equitable by charging the same for long trips as for short trips. At the present time, while some very long trips are possible for 75¢ (Oak Grove to Forest Hills or to Wollaston), very few are actually made. The 1978 passenger survey indicated that over 95 percent of all passengers boarding the outer ends of all rapid transit lines disembarked in either Boston or

Cambridge.[63] Assuming that these figures have not changed significantly, the existing zone system based on the distance from downtown Boston generally works as desired.

To mitigate the impacts of the 1981 fare increase on Quincy residents, the North Quincy and Wollaston stations were moved from Zone 2 to Zone 1. The rationale for the change was that North Quincy was only slightly beyond the six mile limit, and then to balance parking demand between North Quincy and Wollaston, Wollaston should also be moved to Zone 1. The shifting of those stations from Zone 2 to Zone 1 initially avoided any increase at those stations, holding round trip fares at $1.50. Following the fare reduction in 1982, round trip fares dropped to $1.20 – lower than before the 1981 fare increase. Now, after the current fare increase, round trip fares have returned to their 1981 levels.

Consideration should be given to returning North Quincy and Wollaston to Zone 2 to improve system-wide fare equity. This would increase round trip fares to $2.25, which would still be a significantly lower proportional increase than other MBTA rapid transit riders have experienced since 1981. Further, parking fees at both stations are $1.00 per day, which is the lowest rate charged at rapid transit stations. As shown in Table 11-3 when parking costs are combined with round trip fares, the cost per mile from these two stations is significantly lower than for other similarly located

Table 11-3
Round Trip Commute Costs From Stations at Outer Edge of Zone 1

Station	Mileage to Downtown[64]	Rnd. Trip Fare	Parking Cost	Total Cost	Total Cost/ Mile
Alewife	5.9	$1.50	$3.00	$4.50	38¢
Oak Grove	6.0	$1.50	$1.50	$3.00	25¢
North Quincy					
@ Current Fare Levels:	6.3	$1.50	$1.00	$2.50	20¢
w/ Zone 2 Fares:	6.3	$2.25	$1.00	$3.25	26¢
Wollaston					
@ Current Fare Levels:	7.1	$1.50	$1.00	$2.50	18¢
w/ Zone 2 Fares:	7.1	$2.25	$1.00	$3.25	23¢

[63]"MBTA Systemwide Passenger Data Collection Program, Volume 1: Rapid Transit System," CTPS, April 1981.
[64]Red Line to Downtown Crossing, Orange Line to State.

stations. With a change to Zone 2 status, North Quincy costs would become essentially the same as Oak Grove, and both would remain lower than Alewife.

Local Bus The local bus fare system, while termed a zone system, is actually distance-based, with zones based on the distance individual routes travel, not lines on a map. This system is a reflection of a policy to charge higher fares for longer trips, combined with a lack of physical features from which to create more definitive fare boundaries (rivers, bays, an inner belt highway, etc.). In practice, the payment of correct zone fares is very difficult to enforce, and there are indications that fare evasion is high.[65]

However, short of switching to a flat fare system, there are no realistic options to the present system. However, it may be possible to reduce fare evasion by revising fare collection methods (see "Alternative Fare Payment Methods" section).

Express Bus and Commuter Rail Express bus and commuter rail zones are based on the distance from downtown Boston as are rapid transit zones. Express bus service does not permit local trips and nearly all commuter rail riders travel to and from downtown Boston, so that fare evasion is much less of a problem on these services. The zone fare structures on both services are typical of the industry, and continue to be appropriate for existing operations.

Elimination of Fare Differential Between Bus and Rapid Transit

As was shown in Table 9-10, most transit agencies charge the same fare for local bus and rapid transit service. In addition to simplifying the fare structure, this type of pricing is also often based on the philosophy that similar fares should be charged for similar trips, and that differences between the types of vehicles used do not make trips dissimilar. However, in the Boston area, there are differences between the types of service that the two modes provide and the way the two modes are used by riders that are used as the basis for the fare differential. First, for trips of the same distance, the rapid transit service typically provides faster service than local buses. Second, based on 1984 Section 15 data, the average length of a trip made on the rapid transit system is 2.8 miles, compared to 2.3 miles on bus service. Therefore, a higher rapid transit fare is more equitable in the respect that faster service is provided and that longer trips are made on rapid transit.

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[65]Survey responses received from Route 34 riders travelling to and from Walpole and Norwood as part of the South Corridor Bus Study indicated that as few as 17 percent were making base fare trips, but as many as 30 percent paid only the base fare.

The major benefit of eliminating the fare differential would be that a simpler fare structure would result. However, in order to maintain current revenue levels, fares would have to be increased for local bus riders, and reduced for rapid transit riders. Based on the current estimated 50/50 split between rapid transit and bus ridership, the resulting flat fare would be 65¢.[66] This would be a 15¢, or 25 percent increase, for local bus riders, and a 10¢, or 13 percent, decrease for rapid transit riders. The impact of these fare changes would likely be of the same order of magnitude as for the current fare increase (which has yet to be determined).

The elimination of the fare differential would also have implications on pass costs and usage. Under the existing pass system, unlimited use of certain parts of the system are allowed, effectively providing pass users with free transfers that are not allowed with cash fares. The fare differential between rapid transit and bus fares with pass use is maintained through the sale of separate bus (LOCAL BUS) and rail (SUBWAY) passes, neither of which are valid on the other mode. For unlimited travel on both modes, it is necessary to purchase the combined COMBO pass, for $40.00 per month, compared to $18.00 for the LOCAL BUS pass and $27.00 for the rail pass. If the same fare were charged on both modes, it may be difficult to maintain this distinction. However, if the three passes were combined into one, the cost of a combined pass would need to be set at approximately $30 to generate the same amount of revenue (based on July 1989 pass sales). This would result in a large fare increase for bus riders, a small increase for rapid transit only pass users, and a fare decrease for Combo pass users. Overall, fares would be increased for twice as many riders than would benefit: 71,000 LOCAL BUS and SUBWAY pass users versus 33,000 COMBO pass users.

By eliminating the restriction to a single mode for LOCAL BUS and SUBWAY pass users, riders could make more effective use of the system for many circumferential trips. At present, many circumferential trips can be made more quickly by bus than by traveling into downtown Boston and then back out again on the rapid transit system. Examples would be trips from Central Square, Cambridge to areas served by the Auditorium, Symphony and Mass Ave stations better served by Route 1, or from Central Square to Sullivan Square, Charlestown, better served by Route 91. In the case of a Cambridge resident that purchased a SUBWAY pass for work trips, but wanted to make occasional trips to any of those areas, the longer, indirect trip via rapid transit can be made at no extra cost, but full fare would be charged for the shorter, direct trip. The combination of the LOCAL BUS, SUBWAY, and COMBO passes into one pass would eliminate this restriction.

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[66] Estimate of ridership split between rapid transit and bus from CTPS' Regional Transit Model.

In summary, the elimination of the fare differential would simplify the fare structure, including the pass structure, and provide better access to the system to pass users. However, it would be less equitable in that bus riders, who usually make shorter trips, and are often served by routes with longer headways and slower operating speeds, would be charged higher fares. In terms of the other primary MBTA fare structure objectives, a flat fare for Zone 1 services should have little impact on fare evasion or administrative costs.

Free/Discounted Transfers

As previously stated, many other major bus/rail operators offer free transfers. The MBTA does not do so on the basis that transfer trips are generally longer than non-transfer trips, so that a higher fare is charged. The higher fare is then assessed through the imposition of the full fare transfer charge. This system also reduces administrative costs, avoids fare evasion that can occur with free or discounted transfer systems, and simplifies the fare structure. MBTA passes, however, allow unlimited transfers within the zones for which the pass is valid. Further, for bus service only, monthly passes are priced based on the cost of a non-transfer trips, thus effectively allowing free transfers among buses for pass users. The MBTA believes that this system reduces the need for transfers for cash riders and encourages regular riders to purchase monthly passes. However, it does not assist short term visitors and tourists or low income persons for whom the one-time monthly cost of a pass may be prohibitive.

Advantages of free and discounted transfer systems are that they are often perceived by riders as being a fairer system, and that they make it easier to design the overall route structure more efficiently. Trips involving transfers are usually viewed by passengers as being lower quality than direct trips, especially in cases of trips of similar length. Therefore, the transfer charge is often seen as imposing a higher fare for a less attractive trip. In general, if transfer charges are eliminated on trips that are no longer, or not significantly longer, than non-transfer trips, the fare structure becomes more equitable; if transfer charges are eliminated for longer trips, the fare structure becomes less equitable. With respect to route design, transfer charges impose barriers to implementing route changes to make service more cost effective. When service changes would result in new transfers, they are usually opposed by the public because of the fare increase that would result, as was the case in the Southwest Corridor with changes relating to the new Orange Line. By eliminating transfers charges, a major barrier to implementation of many route changes can be removed.

Disadvantages of discounted or free transfers mainly relate to administrative and operating costs, fare evasion and passenger delays. The validity of the transfer slips must be checked, which may cause delays at stations and increase bus dwell time. Due to pressures to avoid these types of delays,

transfers are often not checked adequately, so an increase in fare evasion results. There are also additional costs involved to administer transfer systems, print transfers, and purchase transfer vending machines (for rapid transit stations).

As indicated by the practices of other transit operators shown in Table 11-1, transfers programs can be designed in a number of ways, with transfer fees ranging from free to full fare. Further, free or discounted transfers can be provided for some or all modes and/or certain market segments. Of those currently in use in North America, the MBTA has the most restrictive transfer policies, while the most liberal are offered by Muni in San Francisco and Santa Clara County Transit (SCCTD) in the San Jose area. Muni provides free transfers that are valid for unlimited travel on all modes for three hours. SCCTD system is unique in that transfers are technically not provided, but instead, a "day pass" valid for unlimited travel that day can be purchased for the cost of a round trip fare. Other systems fall in between – most provide free transfers between buses, but most charge at least a nominal fee for bus-rail transfers.

Any of the transfer policies used elsewhere could be adapted for use on the MBTA. Specifically, these would be as follows:

- Free/discounted transfers throughout the system.
- Free/discounted transfers only between local bus routes and rapid transit.
- Free/discounted transfers only between local bus routes.
- Free/discounted transfers between local buses and rapid transit only at certain rapid transit stations.
- Free/discounted transfers only between specific bus routes and rapid transit stations.
- Free/discounted transfers between express buses and rapid transit.
- Free/discounted transfers between express buses and local buses.
- Free/discounted transfers with commuter rail.

As with the elimination of the differential between bus and rail fares, any free or discounted transfer system would require fares to be increased in order to generate the same amount of revenue. The increase required would be dependent on the degree of discount provided on transfers, transfer volumes and impacts on pass use. Discounted transfers would obviously have less of an impact on fares than free transfers; also, the fewer transfers involved, the lower the fare impact.

As shown in Table 11-4, the highest transfer volumes are between local bus service and the rapid transit system (133,000 per day). All other transfer volumes are relatively low by comparison, at 36,700 or less. Therefore, free or discounted transfers between local buses and rapid transit would benefit the greatest number of riders, but also affect fares the most. Transfers between

local buses or between other modes would have lower impacts due to lower transfer volumes.

Table 11-4
1988 Weekday Transfer Volumes

Rapid Transit - Local Bus	133,000
Rapid Transit - Commuter Rail	16,600
Rapid Transit - Express Bus	1,100
Local Bus - Local Bus	36,700
Local Bus - Express Bus	7,100
Local Bus - Commuter Rail	4,300
Express Bus - Commuter Rail	600
Total	199,400

Source: Estimates from CTPS' Regional Transit Model

Free/Discounted Transfers Between Local Bus Routes Of approximately 347,000 weekday trips made on local buses, fewer than 11 percent (36,700) involve transfers with another route. Further, approximately one-third of all local bus trips are made using passes. Although pass use data is not available according to whether transfers were or were not made, it is likely that pass use on transfer trips is higher due the greater discount that passes provide for these trips. However, even assuming that the percentage for transfer trips is no higher than for non-transfer trips, this means that only 24,600 local bus trips involved cash paying transfers, or seven percent of all local bus trips. Due to the the small number of trips involved, the local bus fare increase needed to compensate for lost revenue would be only eight percent, or 4¢ for adult cash fares. Rounding to the nearest nickel would result in a local bus fare of 55¢. Alternatively, if local bus fares were not increased, the MBTA would lose approximately $2.5 million per year.

A free (or discounted) transfer system could be implemented easily and without a substantial capital outlay. Transfers would be both distributed and collected by drivers when riders boarded the bus. Due to the relatively low number of transfer riders, no significant delays would be expected.

Free local bus-to-local bus transfers would permit some very long trips to be made for one fare. However, as with the rapid transit system where the same is now possible (for example, Alewife to Wollaston), it would be expected that these types of trips would make up only a small percentage of total trips. Further, although little data is available on the average length of local bus transfer trips compared to local bus non-transfer trips or rapid transit trips,

indications from bus study surveys are that the large majority of bus transfer trips are not long trips. For example, in the South corridor, approximately 85 percent of all local bus trips involving a transfer with another bus route are made within the city of Boston, within the same town, or between adjoining towns.

Assuming that the bus transfer characteristics from the South corridor are indicative of the rest of the system, then the issuance of free transfers between local buses would make the fare structure more equitable than it is now. Also, since free transfers between local buses are easy to use, they would not make the fare structure any less understandable. They would, however, slightly increase administrative costs, and provide opportunities for fare evasion. Administrative costs would involve the printing and distribution of transfers, as well as accounting for their use. Fare evasion would likely increase slightly as some transfers would be given or sold to others. Considering the relatively small number of transfers that are made between local buses, increases in administrative costs should not be high.

As an alternative to free transfers, discounted transfers could also be provided. This would be less equitable than free transfers in that a higher price would be charged for relatively short trips, but would be more equitable than the current practice of full fare transfers. The benefit of a transfer charge is it would reduce fare evasion – riders not needing to transfer would not buy a transfer; therefore, there would be less likelihood of transfers being sold or given away to others. The "ease of use" and administrative impacts of discounted transfers would not be materially different from a free transfer system.

Free/Discounted Transfers Between Local Bus Routes and Rapid Transit

Providing free or discounted transfers between local bus service and the rapid transit system would have a much larger impact than between local buses due to the large number of transfers involved. The largest impacts would be on fare levels, administrative costs, and depending on the type of transfer program instituted, on the complexity of the fare structure.

With free or discounted transfers, base fares would need to be increased to offset the loss of revenue from 133,000 weekday bus-rapid transit transfers. To charge the same fare in both directions with a free transfer system, it would also be necessary to eliminate the fare differential between bus and rapid transit service. (Otherwise, the cost of an inbound trip from bus to rapid transit, based on current fares, would be 50¢, while the same trip in the opposite direction would be 75¢.) To eliminate the fare differential and to

provide free transfers would require an increase in bus and rapid transit base fares to between 85¢ and 90¢.[67]

Alternatively, to maintain the bus/rapid transit fare differential, free transfers could be provided from rapid transit to bus, but a charge imposed from bus to rapid transit equivalent to the bus-rapid transit fare differential. In this way, the same total fare could be charged in both directions. To do this and maintain a similar differential between bus and rail fares would require bus fares to be raised to approximately 65¢ and rapid transit base fares to be raised to $1.00. The transfer charge from bus to rapid transit would be 35¢. A similar method could also be used at Zone 2 and 3 rapid transit stations – free transfers would be permitted away from rapid transit stations, while the bus to rapid transit transfer charge would be the difference between the bus fare and the rapid transit fare.

It is not possible to determine whether either of these fare structures would be more equitable or less equitable than the current fare structure without more detailed analysis. In general, however, either transfer arrangement would be more equitable for trips from within about a six mile radius of downtown Boston, but both would be less equitable from beyond six miles.

Within a six-mile radius of downtown Boston, bus-rapid transit trips are similar to rapid transit only trips in that the large majority also begin and end within a six mile radius of downtown Boston. Combination bus-rapid transit trips are generally made to and from areas that are not directly served by rapid transit, but otherwise are not significantly different than rapid transit only trips from similar areas. (Examples of these types of connecting trips are most combination bus-rapid transit trips from Roxbury and Somerville.) In addition to the higher fare, combination bus-rapid transit trips are less attractive than direct rapid transit service due to the necessity to transfer, longer bus headways, and longer overall trip times. Therefore, the existing full fare transfer charge is seen by many riders as imposing a higher charge for a lesser service. The elimination of the transfer charge would eliminate this inequity.

From beyond a six mile radius of downtown Boston, combination bus-rapid transit trips generally involve radially oriented feeder routes from outlying Boston neighborhoods and suburbs. Based on the rapid transit zone system, these trips can be considered Zone 2 trips, with the full fare transfer effectively imposing the distance-based zone charge. If free or discounted transfers were permitted between all local bus and Zone 1 rapid transit service, these longer trips would be priced the same as shorter rapid transit only or inner city bus-

[67]Based on 1978 survey data indicating that 29 percent of trips are rapid transit only, 31 percent are surface only, and 40 percent are combination trips.

rapid transit trips. A reduced fare for these types of trips would then be less equitable.

To try to make the fare structure more equitable for bus-rapid transit trips from within the six mile radius while also continuing to charge higher fares for longer trips from beyond six miles, a policy of providing free transfers only at certain rapid transit stations or with certain bus routes could be used. In theory, free transfers could be provided at stations where bus routes connected from within six miles, while full fare transfers could continue to be imposed at other stations. In practice, this would be difficult because of the large number of intermediate stations with routes that connect from both within six miles and from beyond six miles – Malden Center, Wellington, Harvard, Central, Forest Hills, Mattapan, and Ashmont, among others. As an alternative, free transfers could be allowed between buses and rapid transit on specific bus routes. However, as with free transfers at certain stations, some overlap would still exist as several routes operate for significant distances both within and beyond a six mile radius. Therefore, with either free transfers at specific stations or to and from specific routes, a number of individual decisions would need to be made with respect to where free or discounted transfers would be allowed.

Either method would have the potential of improving fare equity. Impacts on fares, the complexity of the fare structure, administration, and fare evasion, would vary depending on where free or discounted transfers were allowed, which is beyond the scope of this analysis. However, it can be generally assumed that fare equity would be improved, the fare structure would become complex and difficult to administer, although probably not unreasonably so. As with any transfer arrangement, there would be some increase in fare evasion. The implementation of free or discounted transfers between buses and rapid transit would also involve the purchase of transfer vending equipment for rapid transit stations.

Free/Discounted Transfers Between Other Modes In addition to free or discounted transfers between local buses and between local buses and rapid transit, free or discounted transfers could be provided to and from express buses and commuter rail. As with other modes, free transfers are now only allowed with passes.

In total, about 29,700 weekday transfers are made to and from express buses and commuter rail. To provide free transfers equivalent to the value of a local bus or Zone 1 rapid transit trip (valid for a Zone 1 local bus or rapid transit trip, or for a discount on higher priced trips), commuter rail fares would need to be increased by about 15¢, and express bus fares increased by about 5¢.

Revised Surface Green Line Fare Structure

As discussed above, surface Green Line operations prevent fare collection on surface lines in the same manner as at attended stations, so a different fare structure is used for surface operations. Since it is not possible to enforce fare collection for outbound riders that board on the surface, no attempt is made and a higher inbound fare is instead collected. However, the way fares are structured, downtown Boston riders pay more on a round trip basis than other rapid transit riders, and local riders pay less.

If Green Line fares were structured based on the zone system, all of the Cleveland Circle and Boston College lines would be considered in Zone 1. On the Riverside Line, stations as far as Reservoir would be in Zone 1, Chestnut Hill and Newton Centre would be in Zone 2 and Newton Highlands through Riverside would be in Zone 3. Round trip fares to downtown Boston would be $1.50 from Zone 1, $2.25 from Zone 2, and $3.00 from Zone 3. By comparison, current Green Line round trip fares to and from the subway are $1.50 on surface portions of the Cleveland Circle and Boston College Lines, and on the surface portion of the Riverside Line, $1.65 from between Fenway Park and Reservoir, and $2.50 from between Chestnut Hill and Riverside.

It would be possible to make Green Line round trip costs more comparable with other rapid transit fares while continuing free outbound surface service by increasing inbound fares and providing free transfers to Zone 1 riders valid for return trip outbound subway fare. In more detail, this would be done as follows:

Zone 1 (All of the Cleveland Circle and Boston College Lines, and the Riverside Line as far as Reservoir) To charge round trip surface riders the same base fare as other Zone 1 riders, a $1.50 inbound fare would need to be charged. This combined with the free outbound trip would result in an effective 75¢ one-way cost.

However, an increase in the inbound fare by itself would then raise round trip fares for downtown Boston-bound riders to $2.25 ($1.50 inbound plus 75¢ outbound in the subway), or $1.13 each way. To avoid this, inbound riders could be issued tickets valid for the return trip subway fare. With this free transfer, the cost of these round trips would then also be $1.50 round trip, or 75¢ each way – the same as other Zone 1 trips.

Zone 2 (Chestnut Hill and Newton Centre on the Riverside Line) At these two stations, a $1.50 inbound fare would also be charged, but no free transfers would be issued. This would result in a $1.50 inbound fare plus a 75¢ outbound fare, for a total of $2.25, the same as other Zone 2 fares. Local riders would be charged the equivalent of 75¢ each way – $1.50 inbound and free outbound.

Zone 3 (Newton Highlands through Riverside on the Riverside Line) At Riverside stations that would be in Zone 3, a $2.25 inbound fare would be charged. This, combined with the 75¢ outbound charge would result in the $3.00 round trip Zone 3 fare. For local Newton trips, the coupon system could be continued, but the value of the coupon would be 75¢. Newton local riders from Zone 3 stations would then pay $1.50 inbound with the coupon, and with the free outbound trip, the effective one-way cost would be 75¢.

The implementation of this fare structure would require LRV operators to distribute transfers at the time fares were paid, and for station agents at attended rapid transit stations to accept the transfers for payment. Distribution of transfers would be relatively straight-forward, but it would be more difficult for station agents to collect transfers, especially as long as they continue to sell tokens (or at least be the only source of tokens). However, as discussed below, the installation of token vending machines at stations would be more convenient for users, and reduce lines at station agent booths. If stations agents spent less time selling tokens, they should be able to effectively collect transfers.

In terms of the MBTA's fare structure objectives, this fare system would still be easy to use, and would be relatively easy to administer once it had been implemented. Fare equity would be improved by charging comparable fares on the surface Green Line as on the rest of the rapid transit system.

Revised Mattapan High Speed Line Fare Structure

On the Mattapan high speed line, a 50¢ fare is charged inbound riders that exit before Ashmont. Riders that exit at Ashmont ride free (on the assumption that these riders are transferring to the Red Line and will pay a 75¢ fare there. No outbound fares are charged. This fare structure results in an effective 25¢ one-way fare for local riders who do not use Ashmont station, and free fares for those that ride to and from Ashmont. These fares are the lowest in the MBTA system.

Fares on the Mattapan High Speed Line could be made comparable to the rest of the rapid transit system by charging 75¢ for all trips but providing free transfers to and from the Red Line. Inbound, transfers would be distributed by Mattapan High Speed Line operators and accepted by Ashmont station agents. Outbound, transfers would be distributed via transfer vending machines inside a paid area of the Ashmont station,[68] and collected by trolley

[68]There is currently no paid area on the outbound platform at Ashmont. Therefore, one would need to be created to institute this transfer system.

operators. The implementation and impacts of this fare structure would be essentially the same as for a revised surface Green Line fare structure.

Peak/Off-Peak Pricing.

Peak/off-peak pricing refers to charging higher fares during peak periods than during off-peak periods. The primary goal of peak/off-peak pricing is to generate additional revenue during peak periods when demand is higher and often less sensitive to fares, or to increase ridership during off-peak hours. However, these effects are often the opposite of other priorities. In many areas, including Boston, a major function of the transit system is to reduce peak period traffic congestion. Therefore, while higher peak period fares would increase revenue, they would also reduce ridership and increase traffic congestion. During off-peak hours, when congestion is less of a concern, maximizing fare revenue is often a higher priority than maximizing ridership.

Additionally, the MBTA has previously experimented with off-peak pricing without much success. In 1973, fares on the Blue, Red, and Orange lines, as well as the Central Subway portion of the Green Line, were reduced from 25 cents to 10 cents between 10:00 AM to 1:00 PM Monday through Friday (called "Dime Time"). The fare on the Red Line Extension to Quincy was reduced from 50 cents to 25 cents. In March of 1974, Dime Time was extended to include an extra hour on weekdays (until 2 PM) and all day Sunday. The experiment was terminated in August 1975, after a study by Decision Research, Inc., was unable to quantify any significant gain in ridership.[69]

Distance-Based Fare Structure for Rapid Transit

The BART system in the San Francisco Bay Area and the Washington Metro in Washington D.C. use distance-based fare structures coupled with electronic fare collection that allow all fares between all stations to be individually set based on distance. (In Washington, fares also vary by time of day.) To do this both systems use "stored-value" fare cards that are purchased for any amount and valid for any combination of rides up to that amount. Riders insert fare cards into the turnstile when entering the system, where the entrance station is recorded, and again when leaving the system, where the correct fare between the entrance and exit stations is determined and deducted from the value of the fare card. The advantages of this type of fare structure is that it allows fares to be set entirely by distance and/or time of day, automates fare collection, and can provide detailed ridership data.

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[69] Decision Research Corporation, "Dime Time Ridership, Study No. 2 for MBTA", Wellesley Hills, MA: Decision Research, June 1974.

In this area, a similar fare structure would be more difficult to implement due to surface Green Line operations. Since there are no fare gates to encode the beginning stop or to deduct fares for exiting passengers, special arrangements would be needed to use a similar system. This type of system would also be relatively expensive to implement, requiring the purchase of all new fare gates as well as the purchase of ticket vending machines for all stations. However, since fares could be set individually for each station pair, this system would result in the greatest degree of equity with all fares based on the distance travelled.

Fare Structure Options - Summary/Conclusions

All of the options described above could be implemented on the MBTA and would have a number of associated advantages and disadvantages. Further, most could be implemented singly or in combination with others. The specific impacts of all would be dependent on proposed fare levels and the various combinations to be considered, which is is premature at this time. However, prior to any subsequent fare changes, further examination of each of these fare structure options should be conducted.

FARE COLLECTION METHODS/ISSUES

The fare collection methods used by the MBTA are, to a large degree, a function of the fare structure, as well as cost and accountability considerations. Currently, four types of fare payment are accepted: cash, token, prepaid pass, or ticket. Passes are accepted on all services, tokens are accepted on bus routes and the rapid transit system, and tickets are used only on commuter rail, the D/Riverside branch of the Green Line and express buses. Exact change in coins is accepted on all buses at all times for all fares. On the rapid transit system, cash is accepted for discounted fares at all times, but for full fares only when gatemen's boxes are open (usually during peak periods or special events).

While these fare payment methods are simple to administer, they are often inconvenient to use and provide opportunities for fare evasion. In addition, existing MBTA fare collection equipment and procedures impose a number of limitations on the type of fare structure that can be used. Many of the inequities in the current fare structure discussed above are, in large part, a function of the MBTA's fare collection equipment and procedures. With more flexible fare collection equipment, the MBTA could make fare payment more convenient as well as revise fare collection procedures and the fare structure, to make fares more equitable throughout the system. Types of equipment that would be compatible with the existing fare structure, make fare payment more convenient, ensure that the proper fare was paid, and provide future flexibility are as listed below.

- Token vending machines in rapid transit stations.
- Turnstiles that would accept both tokens and cash, and dispense transfers.
- Electronic fareboxes on buses and LRV's and devices that would dispense transfers.
- Turnstiles that could be used for an automated distanced-based fare structure.

At present, half of all rapid transit riders pay their fare with tokens. Tokens can only be purchased from station agents, but at most station entrances, there is only one station agent. At heavily used stations, this results in long lines to purchase tokens throughout much of the day. These lines, and their accompanying delays, could be reduced by installing token vending machines at rapid transit stations and/or modifying turnstiles to accept cash payment. Either would be more convenient to riders, as well as reduce the amount of time station agents spent selling tokens. With station agents spending less time selling tokens, they would be able to better monitor fare payment at the collector's booth, which would reduce fare evasion, and verify the validity of transfers (if a transfer system were adopted).

On express buses and the D/Riverside branch of the Green Line, where fares are as high as $1.90, the MBTA recognizes that its policy of requiring exact change but not accepting dollar bills makes fare payment inconvenient. In addition, since existing fareboxes do not count change as it is put into the farebox, it is difficult for drivers to check that the correct fare has been paid. This is more of a problem on express routes with higher fares, but is also a concern on local routes. Both problems could potentially be solved through the use of electronic fareboxes that accept dollar bills and count change and bills as it is put into the fare box (providing the driver with a digital readout of the total), or by providing change machines. The MBTA is now in the initial stages of procuring electronic fareboxes for buses and LRV's that will improve the accountability of fare payment. However, at the present, there are no plans to begin accepting dollar bills because this would require shifting to a different revenue system that would be more labor intensive and more expensive.

It is also possible for turnstiles to dispense transfers and to install transfer dispensing mechanisms on buses. If a transfer system were to be implemented, the dispensing of transfers in this manner would be more effective than through the use of separate transfer vending machines (since the number of transfers dispensed can be limited to one per passenger when they enter or exit), or a separate mechanism on buses.

A comprehensive, automated, distance-based fare structure would require a major change in turnstile and station layout. However, it would allow for

simpler implementation of periodic fare increases, reduce fare evasion, and allow fare charges to be more closely linked to the distance travelled. The MBTA has begun to investigate the use of more flexible equipment for fare collection for use with both the existing fare structure and distance-based fare structures. Preliminary estimates of the cost for the equipment necessary for an automated distance-based fare structure are in the range of $15 - $25 million.

Fare Collection Methods/Issues - Summary/Conclusions

To make fare payment more convenient and to not preclude future options, the MBTA should investigate the purchase of more flexible equipment when replacing existing equipment. Although a cost analysis was not performed as part of this study, it is likely that the additional cost of more flexible equipment would be balanced by reduced fare evasion and improved passenger convenience. Further, with the exception of turnstiles for a "BART"-type system, the equipment described above would be compatible with all current fare collection methods, and therefore could be phased in over time without any disruption to existing service.